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VIEWS, NEWS AND INTERVIEWS.

"Ben Abou" makes the following statement in the New York *Press*:

A stockholder in the Metropolitan Bell Telephone Company told me yesterday that, with over 8,000 subscribers, the expenses of last year exceeded the receipts by nearly $100,000. "Mr. Choate showed the figures to the committees at Albany," said he, "and that is the reason why there was no legislation to reduce the price charged for 'phones."

Mr. C. McCall Smith, of Brooklyn, is trying to run a canoe by electric power.

The Boston *Herald* claims that the fire alarm signaling apparatus used in Boston is inferior to that of other large cities.

Speaking at St. Pancras in March, 1891, Mr. W. H. Preece said: "We find in the Savings' Bank Department of the General Post Office that the cost of the electric light is actually paid for by the increased service we get out of our staff. The electric light has diminished the hours of sick absence two days per head per annum. That, put down at 10*d*. per hour, which is the lowest overtime rate for clerks in the government service, means that we save £680 per annum. Our electric light costs us £700, but after taking credit for this saving it is in reality costing us only £20 a year."

Two Russian engineers have obtained the necessary permission from the Czar to form a company to be known as the Société Electrotechnique Franco-Russe. The object of the company is to erect works at Moscow for the manufacture of all kinds of electrical machinery, and also to undertake the construction of electrical railways, telephonic systems, electric light stations, etc.

Professor Elihu Thomson, whose watt meter was awarded half the prize of $2,000 offered by the municipality of Paris in the recent meter competition, has presented his share of the prize to the French Academy of Sciences.

The argument in the suit of the Edison Electric Light Company against the United States Electric Lighting Company for alleged infringement of the patent for the carbon filament was finished in the United States Circuit Court of Appeals last week. The lawyers talked for eight solid days. The briefs of each side consisted of 250 pages and there were 2,500 folios of argument. Decision is not looked for until October.

Captain Sharp, of Memphis, Tenn., has invented an electrical grass killer, for use in destroying grass and weeds along railroad tracks.

An electric light bulb came ashore at Escanaba, Mich., recently, containing information written on a scrap of paper that the signers' boat had capsized. It was dated 4-19 92, and signed by J. C. Stirling and Joe Baldus.

The Thomson Houston Carbon Company has just drilled in another large gas well in their field, four miles west of Fremont, Ohio. The latest well is said to be the best yet drilled in by the company. The gas is used under the boilers and in heating the carbon furnaces.

Prize Essay on the Transmission of Power by Electricity.

WITH SPECIAL REFERENCE TO ITS APPLICATION TO MINING.

An alumnus of the School of Mines of Columbia College has offered a prize of $100 for the best essay on the above subject that may be presented by a graduate of the school. The essays must be sent to Prof. W. P. Trowbridge on or before November 1, 1892. President Seth Low will appoint a committee to examine the essays and award the prize. The successful essay will be published in the *School of Mines Quarterly*.

Appropriations for Lighting Are Scant.

This year's appropriation for street lighting is causing the city officers some close figuring. It costs $56,000 to operate the south side electric light plants. Comptroller May says he has only $50,000 available for that purpose. Alderman Stuckert, of the sixth ward, called on the comptroller yesterday to ask for relief for the mile square district, bounded by Ashland and Western avenues, and Thirty-ninth street and the canal. It is lighted only by oil lamps, and on business streets, like Archer avenue, they are thought to be deficient. Alderman Stuckert wanted electric lights or gas, but the comptroller gave him no hopes.—*Chicago Herald.*

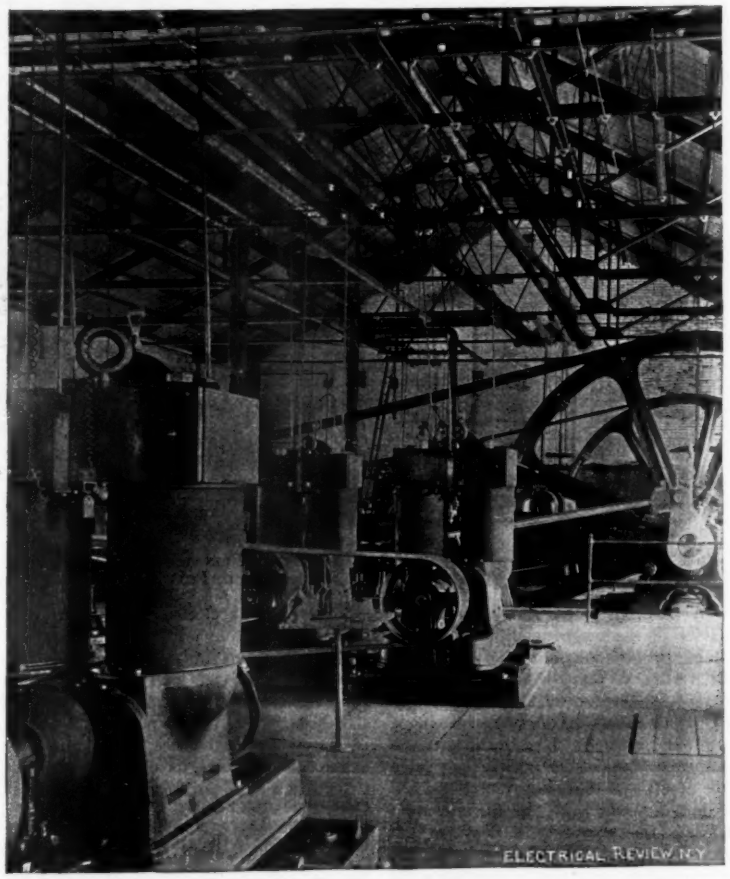


FIG. 1.—INTERIOR VIEW OF A CORNER OF THE CONNECTICUT ELECTRIC COMPANY'S ELECTRIC LIGHT STATION AT WATERBURY, CONN.

The Worcester County, Mass., Electrical Club.

An adjourned meeting of the Worcester County Electrical Club, for the election of officers and completion of organization, was held recently. The following officers were elected: President, B. F. Longstreet; vice-president, Charles H. Page; clerk and treasurer, Oscar F. Dodge; electrician, Charles H. Claflin; assistant electrician, Charles E. Monroe; directors, for three years, J. A. Corriveau, H. B. Willard; two years, Otis C. White, Charles H. Buck; one year, S. J. Burbank, F. M. Ramsdell. The club will be incorporated under the State law.

The Club will hold its meetings at the rooms of the Worcester, Mass., Builders' Exchange until permanent quarters can be obtained.

Anarchists and Electric Cars.

Consternation was caused last week in Buda-Pesth, Hungary, by the explosion of a dynamite cartridge beneath an electric car that was running on Andrassy street. The car was full of passengers at the time, and the dynamite cartridge, which had evidently been laid on the rail, exploded with a deafening report, shattering the car wheel and nearly overturning the car.

When the passengers had got over their panic, no one being seriously hurt, it was discovered that several more cartridges lay alongside the track which, fortunately, had not exploded.

A number of Anarchists have thronged to Buda-Pesth from various parts of Germany, the authorities of Hungary not being so severe in dealing with them as those in Vienna and Berlin.

A Well Equipped Electric Light Station.

The power station of the Connecticut Electric Company at Waterbury, Conn., illustrations of which are presented herewith, is undoubtedly one of the best equipped and most complete plants of its size in the country, and reflects great credit upon the enterprise and business ability of the gentlemen connected therewith. The station itself and all the machinery is of the finest quality, and so arranged as to develop the highest possible efficiency. The building itself is a compact brick structure 250x50 feet. Of this space 180x50 feet is devoted to the machinery and dynamos, the boiler room occupying a space of 70x50 feet in the rear and separated from the dynamo room by a solid brick wall. The entire floor is of concrete, with a wood facing covering the heavy brick foundations on which the machinery rests. The roof is of iron, supported on a skeleton structure also of iron, along which the wires are conducted to the tower above the switchboard, through which they pass in large cables to the poles on the street. Occupying one corner at the front of the building are very neat offices for the use of the superintendent and his assistants, and immediately in the rear of these offices and connected with them, is the stock and tool room, where the supplies are kept and all the necessary repairs made. On the left of the dynamo room and running its entire length, is a line of shafting to which all the engines are connected, and so arranged that one or all may be run separately or together.

Power is furnished by three Corliss engines, one of which is a single Corliss of 200 horse-power, having a 20x48 inch cylinder with an 18 foot driving wheel, and the other two cross-compound Corliss engines of 400 horse-power each, with 18x32x48 inch cylinders and 20 foot driving wheels. There is also an auxiliary 13x12 Ball engine of 100 horse-power, which is used principally during the day. Current is furnished by four No. 20 and two No. 10 Edison straight current machines of the three wire system, with an aggregate capacity of 3,500 incandescent lights, one 1,000 and one 1,300 Thomson-Houston alternator, and nine Thomson-Houston arc light machines, running from 25 to 50 lights each. There is also one 80 horse-power Thomson-Houston generator of 500 volts. The total capacity of the plant at present is about 335 arc and 6,000 incandescent lights.

The engines are connected to a new type of Blake condenser with upright cylinders of 1,000 horse-power, and can be run either condensing or non-condensing, the water entering the boilers at a temperature of 200 degrees. In the boiler room are three 72 inch return flue boilers of 125 horse-power each, two 66 inch return flue boilers of 100 horse-power each, and two 84 inch upright Corliss boilers of 280 horse-power each. Up to this Spring the company have been drawing their water from the Naugatuck river, which flows at a distance of about 800 feet from the station, but having experienced considerable difficulty at times from a shortage of water, they have just completed a system of driven wells, which promises to entirely do

away with this difficulty in the future. There are 20 of these wells, having a depth of 50 feet and a capacity of 1,200 gallons a minute.

The company is at present supplying all the lights used in the city of any description, and on account of the excellent service the demand is constantly increasing. The probability is that in the near future they will also be called upon to furnish power for an electric street railway service, as Mr. A. M. Young, president of the New England Engineering Company, and one of the leading spirits in the Connecticut Electric Company, has purchased a controlling interest in the Waterbury horse railroad, and will shortly bring the matter of changing the motive power of the line to electricity before the Connecticut legislature. Mr. Young is one of Waterbury's most prominent citizens and a firm believer in electric traction. The probabilities are that, with him and his associates devoting their accustomed energy to the project, the citizens of Waterbury may look for a successful termination to their efforts in the near future.

LITERARY.

"Transactions of the American Institute of Electrical Engineers," for March, 1892, have been received.

"Annual Report of the Board of Regents of the Smithsonian Institution" to July, 1890, has been received.

"A Hand-Book of Wiring Tables for Arc, Incandescent Lighting and Motor Circuits." By A. E. Watson. Pocket size, 76 p., illustrated. D. Van Nostrand Co., New York. This is a little volume containing general information and a large number of tables. A unique feature of the work is a series of newly compiled tables of arc and motor wiring systems, brought down to date.

"A Guide to Electric Lighting, for the use of Householders and Amateurs." By S. R. Bottone. 189 p., 77 illustrations. Macmillan & Co., New York and London. Price, 75 cents. The title of this book carries with it the object the author had in view in presenting it to the public. It is a work of an elemeatary character, and appears to be well suited to the needs of the class of readers for which it was intended.

Thomas Curtis Clarke, the eminent engineer, in the June number of *Scribner's* will suggest a solution for the problem of rapid transit as it now confronts the cities of New York, Chicago and Boston. Mr. Clarke has been the adviser of various committees and commissions in these cities, and the plans which he has outlined are eminently practicable. The New York plan which he favors involves a new street with an open air viaduct on one side of it, abutting on great warehouses, the lower stories of which enter directly into the tunnel for freight trains beneath the viaduct.

"Secondary Batteries." By J. T. Niblett. Illustrated, 267 p. Biggs & Co., London. Price, $1.50. The work named is neither a text book nor a scientific dissertation upon the theoretical considerations involved in the construction of apparatus used for the storage of electrical energy. It is an attempt to bring together and describe the recent commercial developments of Planté's original discovery—the lead secondary battery. The information contained in the book has been derived from a great variety of sources and from the personal experiences of the author obtained in the manufacture and management of this class of apparatus.

"Electric Light Cables and the Distribution of Electricity." By Stuart A. Russell. 311 p., 107 illustrations. Whittaker & Co., London. Price, $2.25. Mr. Russell presents in a practical way the results of experiences collected from central station managers and others concerning their work. The extension of central station lighting systems has brought the important problem of the distribution of the current to the front, and of late years the economic distribution of electricity has attracted considerable attention. Much depends upon the durability of the materials employed to insulate the conductors, and it is the author's aim in this work to give the reader a description of the various systems of distribution and types of cable now in use. On the whole this book seems to be one which should appeal to the practical man.

Sun Spots and Terrestrial Magnetism.

In a recent letter to the European edition of the *Herald*, Mr. W. G. Forster, a seismologist of Zante, Greece, opens an interesting question respecting the phenomena of auroras and sun spots. He says:

"The conclusion arrived at by your New York correspondent in his cable report of March 14, attributing the fine aurora seen in America on the previous Saturday to the arrival of a group of sun spots, and the coincidence of the two similar phenomena on February 13, undoubtedly tends to prove that the solar disturbance really does affect, if it does not, indeed, regulate the periodical appearance of the aurora borealis."

Scarcely any deduction in terrestrial physics is better confirmed than this.

But the gist of Mr. Forster's letter is his inference that "when the true generator of electricity, the sun, discharges itself through some unknown (as yet) condition of the components of space, the invisible electromagnetic disturbance of the discharge on the rotating earth is rendered visible 'catoptrically' at the poles, where the magnetic momentum is *nil*." In his view the reason that the display of the aurora is visible at the poles is because there—and there only—is the surface exposed to the rotatory motion of our planet too small to allow electricity to form, and hence the result is light, not power. In proof of this theory, he cites the behavior of the magnetic dipping needle, adding, "at both the poles the needle stands quite vertically, there being no magnetic field, because there is no rotatory surface."

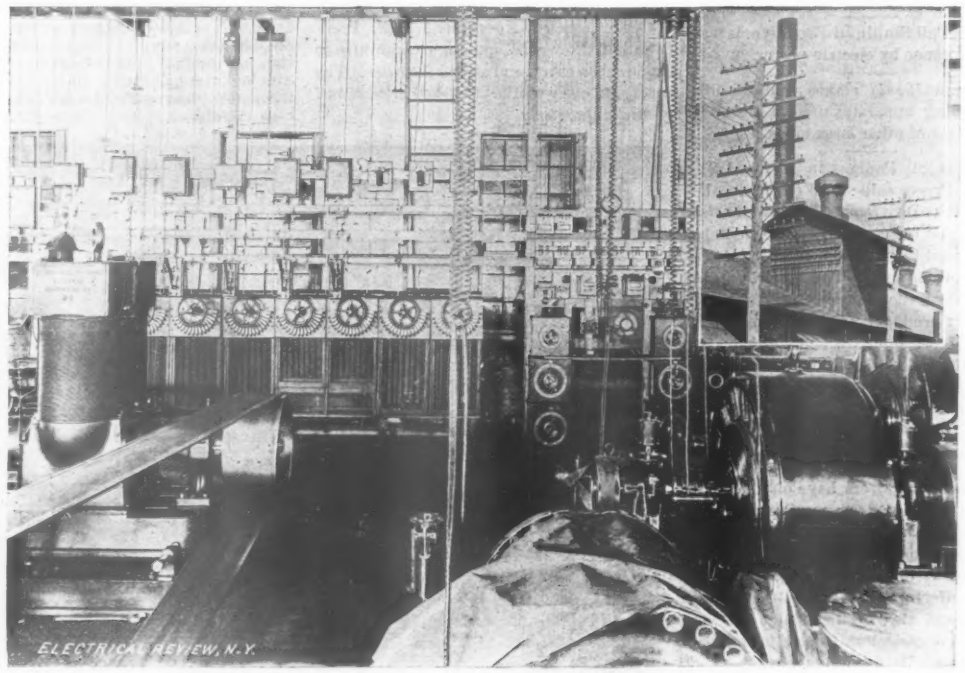
Upon this hypothesis the further we move away from the earth's poles the greater the whirling surface and the greater the change of the needle's position, till we finally reach the equator, "where we get the maximum surface of this gigantic electrical machine speeding through space in its orbit around the sun, and the maximum deflection of the needle now held, of course, horizontally by the conflicting movement of the earth at its center." If the observed facts of terrestrial magnetism bore out all the promises laid down by Mr. Forster his theory would be plausible. But, unfortunately, as M. Flammarion notes, and as all physicians will note, the magnetic needle does not dip vertically at the geographical poles. On the contrary, Commander Ross, in 1831, found that the magnetic north pole lies very nearly in latitude 70 deg. 5 min. 17 sec. north, longitude 96 deg. 46 min. 45 sec. west, almost 1,200 nautical miles from the geographical north pole, and the magnetic south pole is usually located in longitude 150 degrees east and 1,120 miles from the geographical south pole. The magnetic equator, along which there is no dip of the needle, also deviates very much from the geographical equator. These facts show a considerable departure of the earth's magnetic condition from that of a uniformly magnetized sphere in which the magnetic axis coincides with its axis of rotation.

Nevertheless, since the earth is not a homogeneous sphere, Mr. Forster's theory does not require that its magnetic axis shall pass through its center of gravity or that its magnetic poles should be found at its mathematical poles. Moreover, we must admit that while science is far from having determined the causes of terrestrial magnetism, the rotation of the earth must have much to do with the phenomenon. One of the most conspicuous variations of the magnetic elements, and particularly of the declination, occurs on any given meridian every day shortly after noon, just when, by the earth's rotation, that meridian is most exposed to the sun. The effect of this diurnal exposure, though small, is quite similar to the earth's exposure to a group of sun spots. Professor Stokes has forcibly suggested that auroras, earth currents and magnetic changes occurring with outbursts of solar activity may be best explained by supposing that two distant atmospheric regions are charged—one with positive electricity, the other with negative. From each region the ground below is charged by induction. At first neither can discharge its electricity either through the ground or through the cold upper stratum of the atmosphere. But, presently, the radiative power of the sun increases. The solar rays (especially the actinic) will be greedily absorbed by this high stratum, which will grow warmer, and hence, as is known to be the case for gases, its electrical conductivity will be proportionately increased, a discharge will take place in the upper atmosphere, and the charges of negative and positive electricity in the ground below each region being relieved, these charges will rush together through the ground, producing an "earth current" and thus originating a magnetic storm on the globe, with its attendant auroral display.

The earth is, doubtless, magnetically sensitive to cosmical agencies, and it is probable that its magnetism is induced by electricity generated in the luminiferous ether by its rotation. Were the earth a perfect globe of pure steel, and its whole mass entirely homogeneous, it might naturally be expected that the magnetic and mathematical poles would coincide. As it is, however, the peculiar positions of the magnetic poles do not necessarily constitute a fatal objection to Mr. Forster's theory. Balfour Stewart's extensive researches seem to have traced the earth's magnetism to its meteorological system as modified by its rotation and especially to the electric currents in the hot air currents advancing from the equator toward the poles. It cannot be said, however, that Mr. Forster has at all settled the question of the manner in which the earth's magnetism is affected by the solar spots.—*New York Herald.*

An Electrician and the Sparrows.

Mr. Loveridge, the well known electrician, has been the cause of many persons getting shocked by means of the machines he has made, but yesterday he received a shock which made him feel for a moment as if a live electric wire had fallen on him. It will be remembered that a short time since he ventured the assertion that there was not a British sparrow in the city and offered to back his opinion by agreeing to pay a dollar apiece for every one of these birds killed here which should be brought to him. Since that time he has been depositing a portion of the profits of his business in a sort of a "put-a-nickel-in-the-slot" arrangement for fear that he might have been mistaken and that some one might call with a million or two of sparrows. Yesterday the man arrived. He wished to know if Mr. Loveridge was the person who had promised to pay a dollar apiece for sparrows, and on being informed that he had come to the right shop, he said he had a few sparrows in his pocket as a sample, and that if they were satisfactory he would bring in a few thousand more, as there were any number of them out on his and neighboring farms. Mr. Loveridge began to feel pale, and the man ran his hand into his coat pocket and pulled out two of the little red poll linnets, which have been common in this section since Mount Hood was a hole in the ground. The color came back into Mr. Loveridge's cheeks as he saw the birds were not British sparrows, and explained to the man that he had made a great mistake, and that he was liable to be fined or imprisoned, or both, for shooting useful birds, contrary to the law in such cases made and provided. This view of the situation was not a pleasant one to the stranger, who dropped the dead birds in his pocket and took himself off as rapidly as his legs would carry him. Mr Loveridge's sparrow fund still remains intact and his offer is still open, and all he has to say is "Bring on your British sparrows."—*Portland Oregonian.*



FIGS. 2 AND 3.—INTERIOR VIEW OF THE CONNECTICUT ELECTRIC COMPANY'S ELECTRIC LIGHTING STATION AT WATERBURY, CONN., SHOWING SWITCHBOARD, POLE TERMINALS AND WIRE TOWER.

The electric light interests at Newport, R. I., are soon to be re-organized under the charter of the Newport Illuminating Company. The following is to be the new Board of Management: President, T. A. Havemeyer; treasurer, G. B. Reynolds; Directors, T. A. Havemeyer, L. L. Lorillard, Fred. W. Vanderbilt, Robert Goelet, L. H. Darling, A. C. Titus, G. B. Reynolds and H. H. Fry. The plant is to be moved to the Richmond Mill property, which has been bought for that purpose. The company will put in a new plant greatly enlarged over the present one, and as soon as possible abandon the works on Tew's court.

The Electrical Plant Discovered.

IT GROWS IN INDIA AND MR. SEMMES CONTROLS THE MARKET.

Mr. Mayana Semmes, an English electrician and inventor of note, arrived in New York from Southampton last week. Mr. Semmes is of distinguished appearance, his bronzed countenance and almost white hair giving him a slight resemblance to Henry M. Stanley, the African explorer. Mr. Semmes had recently returned to England from an extended series of travels in India. He now intends to revisit America, certain parts of which he has not seen for many years. A representative of the ELECTRICAL REVIEW met Mr. Semmes shortly after he had got settled at his hotel. During a pleasant chat about his travels in out-of-the-way places, Mr. Semmes mentioned his discovery of the electrical plant. The REVIEW man was, of course, astonished and so expressed himself. At first Mr. Semmes would say nothing of his discovery, as he thought there were commercial possibilities in it which he was not yet ready to present to the world; but being reminded by the reader that India was pretty far away, and that it takes time and money to reach there, Mr. Semmes was persuaded to give his discovery to the public, which he did in the following words:

"You know, in the first place," said Mr. Semmes, "that India is one of the most wonderful countries in the world. It is the home of certain species of the elephant, tiger, and of that curious animal recently brought to the attention of the American public by the Rev. Sam Jones, the willapus-wallupus. The Indian fakir, the conjurer, and the famous dancing girl all have their *habitat* in India. And in view of the fact that Rudyard Kipling drew his inspiration from the daily life of the English and natives in India, you must not be astonished that I also have been able to make the discovery which I even yet hesitate to put before the world for fear of the ridicule it may excite; but I am serious and in earnest.

"I have discovered the electrical plant. In the first place, what will astonish you most is that *it is a plant*. It resembles in external appearance what I may describe as a cross between your Western sage brush and the American elm. The branches extend out from the trunk in all directions, and their similarity to the lines of force in a magnetic field is most surprising. The leaves are of a lanceolate form, and are attached to the twigs in groups of three, giving the whole tree the appearance of a bunch of pointed lightning rods. The only place in India that I know of where these trees may be found is in a little forest on a hill back of the town of Chiring, in the Himalaya Mountains. There are probably 1,500 trees in this forest, and I may state in passing that the land on which they grow has been acquired by me.

"Now, a curious thing about this electrical plant is that the hand that plucks a leaf from the tree receives, as soon as the leaf is freed from the twig, a shock equal to that obtained by contact with a large induction coil; and another curious thing is that the strength of the shock varies with the hour of the day, the strongest effects being apparent between the hours of 12 midnight and 2 A. M. (Indian time.) After a series of careful tests, made with the most reliable voltmeters and ammeters, I am perfectly satisfied that by connecting this forest of trees in series I shall be able to light the houses and operate electric fans in the surrounding towns, and if the terrible storms incident to that region do not destroy my forest, and the trees continue to grow, I have no doubt that in a few years I shall also have power enough to run an electric railway from the forest to the town.

"This discovery is entirely my own," said Mr. Semmes, in conclusion, "and although, as a personal favor to you, I will allow you to put the facts before the public, I may say right here that it is of no use for any venturesome spirits to attempt to make the journey to Chiring, as even when they arrive there they will find that not one of the electrical plants is for sale—they are all mine."

Then, with a courtly bow and a sweep of the hand, the REVIEW representative was ushered into the hall.

Electric Traction for Steam Railways.

H. Bonneau, engineer of bridges and roadway, of the Paris and Lyons Railway, and E. Desroziers, a civil and mining engineer, have been studying the problem of electric traction for railway trains. They conclude that steam locomotives are satisfactory for present needs, but in many cases electric traction can be substituted to advantage, especially on metropolitan underground railways.

The absence of combined steam and smoke in underground tunnels would considerably increase the receipts of the road. Electric locomotives would not be so wearing upon the road-bed, and admitting a certain weight for locomotives, they can develop with high speed a much greater power than a steam locomotive of the same weight. The center of gravity can be placed much lower than in steam locomotives; the dead weight is less; the vertical efforts made by the motor wheels upon the rails would be very constant, and electric motors would not slip so easily as steam locomotives of equal adhering weight. This allows greater speed in starting and facilitates ascending grades. Electric locomotives would reach a speed without danger that could not be exceeded with steam without serious inconvenience.

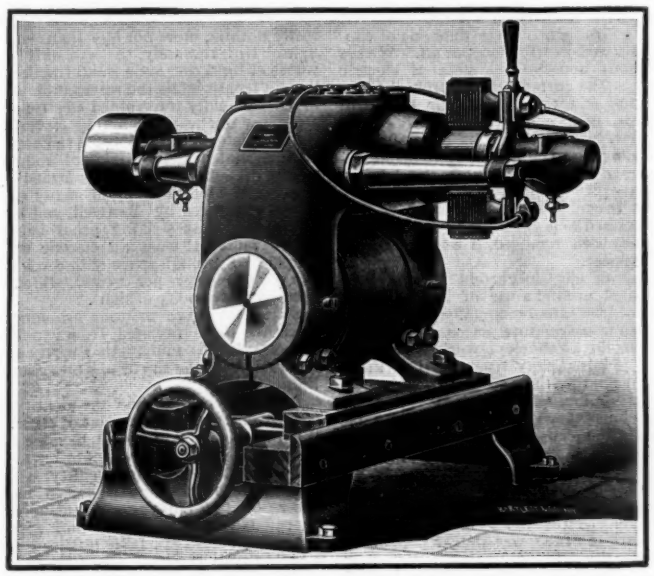
The engineers named conclude that with electric locomotives the speed of an express train can be increased at least 50 per cent. The type of motor adapted for express trains, metropolitan roads, etc., which these engineers have studied, is of very high speed. It has two independent axle motors, the diameter of the motor wheels being 7 feet 7 inches. Each axle is operated by a Desroziers motor, whose armature is particularly light, surrounding the axle. The frame of the machine, which rests upon boxes and springs placed upon the axles, as in a steam locomotive, supports the motors by intermediary, vertical and horizontal springs, so as to weaken the reactions that the motors will be subjected to on account of the irregularities of the track. The springs are regulated so that the axle in turning does not touch the interior of the hollow shaft upon which is wedged the armature. The connection between the armature and the wheels is made by means of an arrangement of Rafford plates. When the current passes into the motors the armatures commence to revolve. The plates wedged to the ends of the hollow shaft draw in this rotating movement stretching the springs more and more which unites them to the motor wheels, and when the sum of the tensions are equal to the effort of starting the train the latter commences to move. The engineer gradually increases the quantity of electric energy sent into the motors and the speed of the train increases.

It is shown that the power upon the felloes of the wheels of the locomotives at different speeds is such that a train of 180 to 200 tons, not including the locomotive, can be hauled upon lines of moderate grades at a speed limited only by the resistance of the track.

Current will be produced by steam engines, or, when it is possible, by hydraulic power in the great factories situated at convenient points along the line of the road. Accumulator stations suitably placed can be used in connection with the power stations. Current will be carried to the trains by conductors placed along the track and brought to the motors by means of brushes, friction or rollers. These particulars are abstracted from a recent article on this subject in the *Railway Review*.

A New Jenney Motor.

The motor illustrated herewith is of the well known Jenney type, but several new features have recently been added. All field coils are now wound upon insulated spools and afterwards slipped over the cores. The bearings are self-oiling and in the larger sizes self-aligning. Brush holders fitted with composite carbon brushes are so attached to the rocker-arm that the carbons always press upon the commutator at diametrically opposite points. Machines above one horse-power are fitted with sliding base and belt tightener. These motors are made either shunt or series in all the standard sizes and voltages. The Jenney Company, of Indianapolis, Ind., also manufacture a complete line of dynamos and power generators.



A NEW JENNEY MOTOR.

Did Not Enjoy Earthquakes.

During the recent series of earthquake shocks Mr. Geo. T. Manson, of the Okonite Company, New York, and Mr. W. H. McKinlock, president of the Central Electric Company, Chicago, were enjoying life on the Pacific coast, with headquarters at the Palace Hotel, San Francisco. The first two or three shocks—one of which threw Mr. Manson out of bed, and another which woke both of them up by the table bumping against the foot of the bed—did not really affect their state of mind very much, but along about the time of the arrival of the sixth shock they decided that they knew when they had enough, and quietly stole away, but as far as heard from stole nothing else.

On the occasion of Mr. Manson's visit to San Francisco a couple of years ago there were a number of earthquake shocks at that time, so he has become quite accustomed to them. (There are a few Californians mean enough to say that Mr. Manson might be in better business than bringing in earthquakes, and that he can stay away if he doesn't mind.) This, however, was Mr. McKinlock's first experience of the kind, and if he can arrange it it will be his last.

They both state that it is not at all a reassuring sight to be sitting in your room and see the chandelier waving back and forth, table sliding across the floor and the bed climbing up the wall. One never knows what to do, the only apparent escape being by means of a balloon, and when the earthquake arrives the balloon is not always at hand.

What Electricity Is—Illustrated by Some New Experiments.

AN ADDRESS DELIVERED BEFORE THE AMERICAN ACADEMY OF ARTS AND SCIENCES, BY PROF. W. W. JACQUES, JANUARY 13, 1892.

Electricity is, to all of us, more or less surrounded with an atmosphere of mystery.

When we speak of Light, or Sound, or Heat, we feel that we are dealing with familiar things—things so familiar to our every-day life that it seems useless to try to define or describe them. Every day the sunlight fills all space; it dazzles our eyes; it falls upon the objects around us, and makes them visible; and though through the evening, when the sun is gone, we substitute for a while a gas flame, or a candle, or an electric light, we have then through the day had so much of it that at night we are glad to be rid of it, and have darkness for our hours of repose.

So, too, from babyhood to old age, all day long and every day, we are listening to one or another sound, whether the voices of friends, or the busy hum of city life, or the delights of music, or the ticking of the clock at night. Indeed, so constantly are our ears filled with sounds, that, when we go alone on a high mountain, or a desert plain, where there are no trees to rustle with the wind, the silence is painful and oppressive and awful.

Heat, too, is equally familiar, perhaps even more so; for what is more familiar than the warmth of sunshine? And is not the fireside the very center, as well as emblem, of our home?

When, however, we speak of that other great force of nature, *Electricity*, we feel that we are departing from familiar ground. It is shrouded in mystery; it is something we cannot see, or hear, or feel—something we cannot easily describe or define. We speak of it in the same breath with spirits and with ghosts. The reason, I take it, is because the human body has no organ especially adapted to recognize electrical phenomena. While the eye receives the ray of light, the ear the ray of sound, and any part of the surface of the body feels the heat, the presence of electricity cannot be detected by any of our senses. Electricity cannot be seen, or heard, or felt; it is tasteless and odorless.

Subjectively considered, then, electricity eludes our grasp.

Objectively, however, electricity is as familiar to us as light, or sound, or heat. Its phenomena have been as carefully studied, and its laws are as accurately known.

Let us for a moment recall the physical explanation of light and sound. Let us picture to the eye of the imagination the mechanics of a ray of light.

When we stand out-of-doors on a cloudless night and look above us, we see a multitude of stars. The telescope tells us that some of these are suns, some are moons, and some are other worlds than ours.

The nearest of them is distant millions of miles, and yet we can see them. There is a chain of something linking the star at which we are gazing to the eye. This chain we call, familiarly, a ray of light. Physicists tell us that along the pathway from the star to our eyes there are chasing each other, with enormous speed, a multitude of waves of light.

If we turn our eyes to another star, it, too, sends to our eyes its waves of light. If we go to a distant part of the earth the same stars send rays of light to us there. And so we find that each of the multitude of stars is radiating ceaselessly in all directions multitudes of waves of light.

Between us and the stars, and between the stars extending everywhere through visible space, is the medium that transmits these waves, crossed and intercrossed continually with countless waves of light—a medium rarer than the rarest gas—the medium that is still left in space when we remove from it all solids and liquids and gases—*the ether*.

Objectively considered, then, light is a

wave motion of the ether that everywhere surrounds us and fills all space. By a similar wave motion, but in a coarser medium, the air, sound is transmitted from place to place.

By means of his vocal organs a public speaker moulds the current of air that issues from his lungs into waves of sound. These waves of sound are radiated in all directions and fall upon the various listeners' ears.

Something analogous takes place when we drop a pebble onto the surface of a placid lake. From this center of disturbance waves of water are radiated in all directions until they reach the shore. Waves are likewise radiated downward to the bottom of the lake, and fishes have organs, like our ears, that enable them to take cognizance of these vibrations.

In the case of waves of water, or waves of sound, or waves of light, we know there is no bodily transference of a particle of water, or air, or ether, from the center of disturbance to the shore, or ear, or eye. Each particle moves at the most only through a minute fraction of an inch; but each pushes the next, and this the next, so that motion, and not matter, is what is transmitted to a distance. Indeed, this propagation of motion, in contradistinction to propagation of matter, is the essential characteristic of wave motion.

Who has not seen a wave pass over a field of grain? Each particle bows its head but for a few inches, yet the wave passes on to the utmost limit of the field.

Sound, then, is a wave motion transmitted through the air. Light is a wave motion transmitted through the ether. But both of these media are also capable of having set up in them currents in which there is an actual bodily transference of the medium from place to place through considerable distance.

In the case of air, we call this motion the wind. In the case of the ether, I propose to show that it is a current of electricity.

As wind is the bodily forward motion of the medium whose vibratory motion we call sound, so a current of electricity is the bodily forward motion of the medium whose vibratory motion we call light.

A current of electricity is a breeze of light.

We may, perhaps, best get a realistic conception of electric currents, whether flowing through open space or confined to a specially provided metallic conducting path, by first picturing to ourselves the phenomena of air currents, with which we are more familiar, and then mentally transferring these phenomena from the air to the more subtle medium, the ether. The analogies are very striking, and will materially aid the imagination in picturing electrical phenomena.

In the islands of the Pacific Ocean there is almost always a breeze, either from the land to the water, or from the water to the land. In the daytime the island is heated by the sun, its air is rarefied and rises, and the cooler breeze rushes in from the ocean so take its place. At night the island cools, the air descends, and an outward breeze it produced. There is always a breeze from an area where the air is condensed, and towards an area where it is rarefied. This local condensation and rarefaction of the air are the cause of breezes and winds and hurricanes. The maps issued by our weather bureau show areas of high and areas of low barometer, and the direction of the wind is always from the one to the other.

If, instead of allowing the wind to blow freely through space, we confine it to a narrow channel—if, for instance, we produce an air pressure at one end of a long iron pipe, we get through the pipe a strong current of air—as, for example, in pneumatic tubes, in which the current of air carries along small carriages, in the tin pipes used to convey the hot air currents from our furnaces to the registers, and in the pipes used for distributing illuminating gas from the central gasometer to the houses about the city where it is burned.

The wind blowing through space is made evident to our eyes by its scattering of a handful of dry leaves, or dust, or bits of paper. It bows and bends the branches of the trees. A candle flame exposed to it is distorted, or instantly blown out. Its direction is more accurately indicated by the familiar weather-vane, and its strength is measured, if we will, by the anemometer.

As with the wind of nature, so, too, with the electric wind. If we substitute for our Pacific island a metal ball suspended in mid-air by a silken cord, and let the ocean be represented by the surrounding atmosphere on a moist day, and produce upon the ball an area of *electric* condensation, or, as an electrician would say, a positive electric change, we shall have an electric breeze blowing outward in all directions, which will last so long as the electrification of the ball is above that of the surrounding air. This may be made evident to the eye by placing upon the ball a handful of bits of paper, or dry leaves, or dust, any of which will be instantly blown away and dissipated in all directions. If a lighted candle be brought near the ball, its flame will be bent by the breeze, and possibly be blown out.

If, instead of allowing this electric wind to blow away in all directions, we confine it to a narrow path—if, for instance, we connect the ball to the earth by a metallic wire—we get through the wire a strong current of electricity, whose direction may be determined by the electric weather wave, a magnetic needle, and whose strength may be measured, not with the anemometer, but by the galvanometer.

We may conceive of this electric wind as a breeze of the ether; the proof of the indentity will be given later.

It is in currents flowing along metallic wires that the phenomena of electricity have been most carefully studied, and it is the phenomena of such currents that have, therefore, been for the most part utilized in electrical inventions.

Nature's wind is used to waft our ships across the seas, and it is, perhaps, not a wild idea to conceive of electric repulsion utilized to support and propel heavily laden air ships through the space above our heads; but it is with electric phenomena, as they have been investigated and utilized up to the present time, that we have to deal in this article, and this, as we have seen, means the phenomena of electric currents flowing through metallic wires.

What are some of these phenomena?

Electricity—or what we shall soon see is the same thing, a current of ether—passes readily through a copper wire. To the ether current the wire is hollow; in electrical terms, it is a good conductor. It also passes quite readily through an iron wire, but not so readily as through copper. It passes still less readily through a wire of carbon. It passes more readily through a large wire than through a small wire. In all wires there is more or less ethereal friction or electric resistance.

In virtue of this ethereal friction or electric resistance, the current heats the wire through which it passes—of course, heating a small wire more than a large one, and heating an iron wire more than one of copper, and a carbon wire most of all. We see this in our household system of electric lighting. The current passes from the central station and throughout our houses to the lamps, over comparatively large wires of copper, which it warms only slightly, but, coming to the lamps, it passes through a fine wire of carbon, in which the friction and consequent heating is so great that the filament becomes white heat; and were it not contained in a glass globe, from which the air has been removed, it would take fire and disappear.

Again, an electric current flowing in a wire coiled around a bar of iron converts the bar of iron into a magnet, so that it may attract an iron armature placed near its end, and thus do mechanical work. The converse of this is equally true, and if we move an iron armature to or from the end of an iron bar around which a wire is coiled, an electric current will be set up in the same coil, and by means of the connecting wires, may be carried to a distance and utilized. On this latter principle depends the dynamo machine, which furnishes electricity to be used for light or power. On the former depends the electric motor that propels our street cars and furnishes power to many of our industries.

Again, the electric current flows through wires with enormous velocity, and, consequently, it offers an excellent vehicle for the rapid communication of intelligence—for telegraphy. A telegraph wire between two cities is merely a path through which the current may readily flow. At one end is a reservoir of electricity. The "key" is a device by which electricity may be allowed to flow into the line. By allowing small quantities of electricity to flow into the line at intervals of time in accordance with a pre-arranged code, and noting at their distant end their arrival, we may communicate any ideas that are capable of being expressed in such a code.

The arrival of these little currents of ether may be manifested to the eye in various ways. In the so-called needle telegraph, the current, passing by a magnetic needle, causes it to point in a given direction, just as the wind passing a weather-vane causes it to point in a given direction.

If it were possible to have on one hill-top a reservoir of air under pressure, or wind, and a key by which small puffs of air could be let out at intervals in accordance with a pre-arranged code, and on a neighboring hill a weather-vane, we might thus have a wind telegraph operated exactly as is the electric telegraph. But such a telegraph would be slow and cumbersome in operation, and is not likely to come into general use.

There is one other phenomenon on which I desire to dwell a moment—a phenomenon of great importance, as it furnishes the first proof of the identity of electricity and the ether.

Suppose we have an ordinary telegraph wire in which there is a steady current flowing. Suppose 10 feet away from this wire, and entirely disconnected from it, we arrange a short wire with any suitable means of detecting an electric current in it, should such a current exist. So long as the current in the first wire flows steadily on, there will be no current in the secondary wire. If, however, the current in the first wire be broken up into rapid pulsations, say, 100 per second, by rapidly opening and closing the circuit, we shall find in the secondary wire short pulsating currents occurring with the same frequency. How does this action take place? How are the impulses transmitted across apparently unoccupied space? The only conductor between them is possibly moist air, but the same phenomenon takes place if the air be dry, or even if it be entirely removed. The only remaining explanation is that the pulsations are carried from one wire to the other by means of the intervening ether which we know fills all space. We shall see in a moment that the pulsations are transmitted by means of a wave motion of the ether from the one wire to the other.

Meanwhile, let us look at the analogy of this phenomenon as it takes place in a current of air.

Suppose we have a pipe in which there is a steady current of air flowing. Suppose ten feet away we place our ear. So long as the current of air flows steadily on, no sound will be heard. If, however, the current in the pipe be broken up into rapid pulsations, say, 100 per second, by rapidly opening and closing its end, which may be done by means of a reed such as is used in organs, the pipe will radiate in all directions waves of musical sound of a pitch due to 100 vibrations per second, and this sound will, of course, be heard by the ear. In this case have a current of air, by rapid interruptions, converted into waves in the air, or sound.

Analogy indicates that, in the former case, we had a current of ether (or electricity), by rapid interruptions, converted into waves in the ether (or electrical waves). But we must have stronger proof than the indications of analogy, and it is readily forthcoming.

If the interrupted current in the wire radiates ether waves, these ether waves are really nothing more nor less than waves of light. Unfortunately, the eye only detects waves of light that are a small fraction of an inch in length, while the waves radiated from the most rapidly interrupted electric current are many inches in length. Nevertheless, the complete identity of waves radiated from an interrupted electric current and from a source of light has been confirmed by the study and identification of many of their phenomena, first by Maxwell, and later by Hertz; the most striking proof being that waves radiated from an electric wire are propagated through space with a velocity of 300,000,000 meters per second, which is the same as the velocity of light.

So far as wave motions are concerned, therefore, those radiated from an electric wire are just as much ether waves as those radiated from the sun or any other source of light.

It remains now to show the identity of the electric current and a current of ether. For this I invite your attention to some experiments of my own, that seems to me to go far towards establishing this identity.

If we can find somewhere in nature a breeze of ether blowing with the necessarily enormous velocity freely through space, and show that it exhibits both qualitatively and quantitatively the same properties as an electric current, the simplest possible supposition that we can make is that they are identical.

Now, the earth in its daily journey round the sun rushes through the ether that fills all space with enormous velocity, and to the observer on the surface of the earth this is the same thing as if the earth were at rest and the ether flowed by with this same velocity. Just as the observer on the deck of a swift steamship at sea feels the same breeze, whether the ship moves forward with a speed of 20 miles an hour through a calm atmosphere, or the breeze blows with a velocity of 20 miles an hour by the steamship when at anchor.

Now, our problem is to detect and measure this ether breeze, and show that qualitatively and quantitatively it possesses the properties of a current of electricity. This I have done in the following way.

Before us stands a very sensitive balance, capable of detecting a variation in weight of one part in a million. I have replaced the scale-pans with thin disks of brass, ten centimeters in diameter. Above and below each disk, and supported from the floor of the balance by glass legs, are other similar disks of brass. The two suspended disks are, of course, free to move up and down, but remain at rest so long as the equilibrium of the balance is undisturbed.

The remaining four disks are rigidly fixed, excepting as each can be raised or lowered by a delicate micrometer screw. For convenience I will designate the right-hand disks *Rt*, *Rm* and *Rb*, indicating, respectively, right-hand top, right-hand middle and right-hand bottom. Similarly, I will designate the left-hand disks *Lt*, *Lm* and *Lb*. By means of a suitable battery I may electrify any of these plates, either positively or negatively.

Suppose, now, I electrify the beam of the balance, and consequently plates *Rm* and *Lm* positively. If the distance between plates are in all cases the same, the index will remain at rest. If it deflects, we know the distances are somewhere unequal, and must be adjusted, by means of the micrometer, until there is no deflection.

If, now, I electrify *Rt* negatively, it will attract and lift *Rm*, and the index will move to the right.

If, however, I, at the same time, electrify *Lb* positively, it will tend to repel and lift *Lm*, and, as the repulsive lifting of *Lm* is equal to the attractive lifting of *Rm*, the index will remain at rest. That is, an *attraction* between *Rt* and *Rm* is balanced by a *repulsion* between *Lb* and *Lm*.

If, now, I suddenly change the electrification of the beam of the balance and, consequently, of the plates *Rm* and *Lm*, to negative, we have a *repulsion* between *Rt* and *Rm*, balanced by an *attraction* between *Lb* and *Lm*.

Now, it can be shown by purely mathematical reasoning from electric phenomena (see Maxwell's Electricity and Magnetism, chap. xix) that an ether current flowing between two positively electrified plates would, provided it possessed the electromagnetic properties of a current of electricity, diminish their repulsion. If it flowed with the velocity of light, and had quantitatively, as well as qualitatively, the electromagnetic properties of a current of electricity, it would just *neutralize* the repulsion.

If, on the other hand, it passed between two plates, one of which was charged positively and the other negatively, it would just double their attraction.

If, instead of moving with the velocity of light, 300,000,000 meters per second, it moved only $\frac{1}{10000}$ as fast, or 30,000 meters per second, the repulsion between similarly electrified plates would be diminished by one part in 10,000 and the attraction between oppositely electrified plates increased one part in 10,000.

Now, it can be further shown, from purely astronomical measurements, that our balance is, on the 22d of December, at noon, carried through space with a velocity of 30,000 meters per second.

Observations made at noon on that day, then, ought to show the index of the balance one side of the position of equilibrium when the movable plates are electrified positively, and the other side when electrified negatively. The difference should indicate a total change of force of one part in 2,500.

This deflection of $\frac{1}{2500}$ is that due simply to the rotation of the earth around the sun. That due to the rotation of the earth about its axis is too small to note. But the whole solar system is moving towards Hercules with a velocity of 8,000 meters per second.

On the 22d of March this velocity would have to be added to the velocity of the earth in its orbit, and on the 21st of September subtracted. On the 22d of December it would have no effect. Our deflection on March 22, then, should be about $\frac{1}{5000}$; on December 22, $\frac{1}{2500}$, and on September 21 $\frac{1}{3750}$.

Of course, in actually taking observations, it is necessary to use all six of the plates, variously grouped and variously electrified, in order to get rid of accidental phenomena.

Even then the accidental phenomena frequently mask that for which we are searching, and it is only from the discussion of a considerable series of observations that results of value are obtained.

I began my observations last September and have continued them at intervals since. The results observed are of the order of magnitude predicted, and vary, as expected, with the season of the year.

If, continued until next September, the cycle is complete, I shall feel even more sure of having discovered the phenomenon for which I am searching, and of showing that the motion of the ether possesses, both qualitatively and quantitatively, the properties of an electric current—that *an electric current is a bodily forward motion of that same ether whose undulations we call light.*

Electrocution.

It will probably be conceded that execution by electricity is not a success, now that criminal lawyers in New York have begun to use it effectively as an argument in favor of their clients in capital cases. On the trial of Mrs. Walden, last week, in New York, for killing her husband in a very cold blooded manner, counsel for the defense dwelt in an eloquent manner on the sizzling flesh in the fatal chair and the other gruesome features of this mysterious and repulsive form of punishment, with the result that a sympathetic jury diluted their justice into a verdict of murder in the second degree. If capital convictions are to be obtained in New York they will have to provide some more popular and agreeable means of taking off.—*Oakland, Cal., Tribune.*

Illuminated sky signs operated by arc lights are in use in England.

Waterhouse Bros.' Arc Lamp for Arc or Incandescent Circuits.

A lamp recently placed upon the market by Waterhouse Bros., of Hartford, Conn., has several new and striking features well worth the attention of those interested in arc lighting. It is believed by the makers that this lamp fulfills all the requirements found by long experience to be necessary,

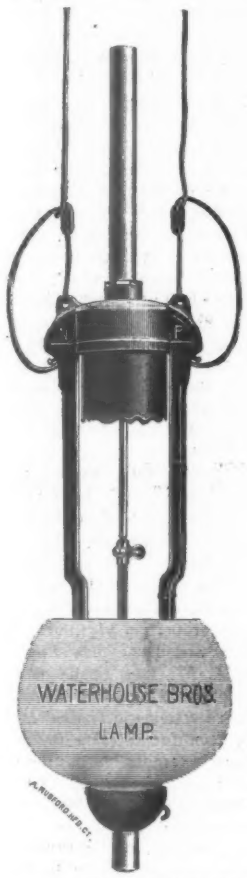


FIG. 1.—WATERHOUSE BROS.' ARC LAMP.

and wherever placed they have given the best of satisfaction.

Fig. 1 shows the lamp complete and ready for use; Fig. 2 shows the frame with works removed; Fig. 3 the works with carbon rod attached, and Fig. 4 the works without rod. As will be seen from Fig. 1, the lamp is very neat in design, light and compact in construction. It is both dust and weather proof, requiring, when placed out of doors, no protecting hood or canopy. Its length over all is 45 inches and weight 23 pounds. In Fig. 2 is shown the attachment for holding the globe while trimming or cleaning the lamp. The globe holder is dust proof, and made in cup shape, so as to form a receptacle for the carbon dust and doing away with the necessity of taking off the globe every time the lamp is trimmed. With this style of holder the dust can be brushed down and remain for two or three weeks, as it sets far enough below the lower carbon holder and terminal to overcome all danger of short circuiting or grounding. When necessary to empty the globe, simply unhook the chain from the frame and tip the globe. The globe is intended to be at all times fastened to the holder, thereby lessening the danger of breaking globes. The holder is fastened to the frame by a snap spring which engages with a hole in the side of the frame, which can be seen by referring to Fig. 1. Fig. 2 also shows how the outside connections are brought to the lamp, and how connection is made with the working parts of the lamp. The binding posts for circuit wires are carried underneath out of the way of the weather, making much neater and safer terminals than those usually attached to top of frames. These are thoroughly insulated from the frame by an insulating cement, which is both fire and waterproof, and attached to an anchor plate in the cap of the lamp which is also insulated from the frame in the same manner. From this same plate project two wires to which the works are attached. Fig. 3 shows the works in detail. From the form of magnet used, great strength and very wide range is obtained. There are no springs used and there is but one piece of insulation in the whole lamp outside of the insulating cement before mentioned. The clutch-form of feed is used, as it has been proved by long experience to be the most practical as well as the most reliable style of lamp for both inside and outside lighting. The only objection heretofore being its tendency to over-feed when the rod becomes a little worn. This objection is entirely overcome in this lamp by the peculiar device on top of the carbon rod. This is an air plunger working a peculiar clamping device inside of the chimney of the lamp and by which a steady, positive feed is obtained at all times. The steady feeding qualities of this lamp are especially noticeable on incandescent circuits, where it is necessary to have a very quick and positive feed, and, by its quick and positive action, entirely overcomes the tendency of one lamp robbing from another, where they are run in series, across mains above 75 volts. The works are interchangeable, fitting all frames alike. The works are the same for arc circuits as those for incandescent circuits; the only change being in the cut-out. All parts of the lamp are made by machinery, and must interchange without any filing or fitting. It is impossible for a lamp to get out of alignment. The magnet coils are so placed that they can be slid out of the cage in a moment's time and a lamp changed from one-half to full arc, or *vice versa*, by simply changing the magnets. Having works and frame separate, it is not necessary to carry the

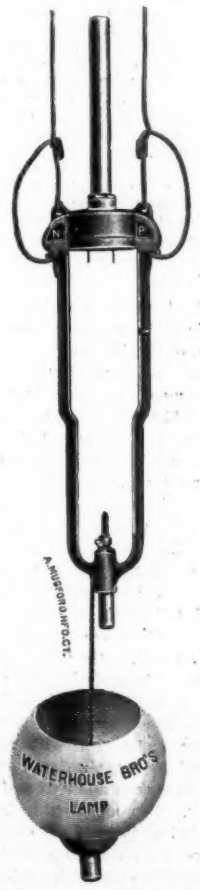


FIG. 2.—WATERHOUSE BROS.' ARC LAMP, WITH WORKS REMOVED.

whole lamp to the station when it is in trouble, but leave the frame hanging and simply remove the works, replacing them by a new set, which can be carried in the coat pocket and attached in a very short time, the loosening and tightening of two screws being all that is necessary.

Fig. 4 gives another view of the works, showing two screws on top, which go into an anchor plate in the top of the frame and connect the works to circuit. The lamps are made to run on any circuit, arc or incandescent, at any voltage, and from five amperes up. Carbon holders for ⅛, ⅜ and ⅝ inches are provided, so that lamps will run all night if desired, and suitable hanger boards and resistances for both inside and outside lighting.

It has been the design of the makers to make this a thoroughly practical arc lamp, one that can be used on any circuit and taken care of by ordinary help; it is very

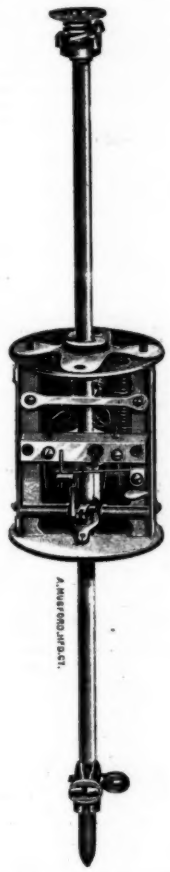


FIG. 3.—WORKS OF WATERHOUSE BROS.' ARC LAMP, WITH CARBON RODS.

simple, the wearing parts are few, and repairs are reduced to the lowest figure, as all parts are made in exact duplicate.

How She Enjoyed Herself.

It is probably the meanest trick ever played by a telephone girl, and that is saying a good deal. After she had finished manipulating the telephone wires, the following conversation ensued:

"Hello!"

"Well?"

"This is Mr. Brown."

"What of it?"

"What of it! Why—why, is Millie there?"

"Why don't you come out and see? You don't suppose I know all their names, do you?"

"Don't know all their names!"

"Of course not. I can't keep track of them. What's her color?"

"Color! Color! Look here, sir, what do you mean? Are you trying to insult me? What color do you suppose she is?"

"How should I know if you don't? Better get some kind of a description of her or quit bothering me. I don't know her from any other dog."

"Who is this?" roared the young man. "Tell me who it is, and I'll teach you!"

"The poundmaster."

"O—o—o! Ring off, please."—*New York Sun.*

The Central Electric Company report that they have secured the order, through the Brush Electric Company, for 32 miles of "Acme" lead covered Okonite cable for the South Park Commissioners, of Chicago, the wire to be used in carrying current for the lighting of the boulevards to the World's Fair grounds; Okonite being selected because of its high quality, and being able to conform to the stringent guarantees required.

A Government Electrician Wanted.

James R. Soley, Acting Secretary of the Navy, has issued the following special order:

NAVY DEPARTMENT, May 12, 1892.

1. An examination of applicants will be held at the Navy Yard, New York, Tuesday, May 31, for filling the following position:

EQUIPMENT DEPARTMENT.

Master Electrician ($6 per day).

2. The examination will be open to all comers who can give evidence of experience in conducting the kind of work for which they seek employment, and who are citizens of the United States. Persons now holding positions at the yard will be admitted to competition on the same footing as other applicants.

3. Applications will be addressed to the Commandant, Navy Yard, New York, and must be addressed to him on or before Saturday, May 28. No applications received after that date will be considered.

4. Each applicant will state in his application his name, age, residence, citizenship, present occupation (stating shop and position therein), and previous employment or work done.

5. The application will be accompanied by evidence of citizenship, and by certificates, preferably from previous employers, as to character, habits of industry and sobriety, and skill and experience in conducting the kind of work required.

6. A Board of Examiners will convene at the Navy Yard, New York, on May 31, or as soon after as practicable.

7. Applicants will be informed as to the date on which they will be required to report for examination.

8. The examination will be practical in character, having reference exclusively to the requirements of the position to be filled. It will be directed to ascertaining the applicant's knowledge of his business, and his possession of the qualities that will enable him to get good work out of his men.

9. The applicant's antecedents and experience in his trade, as well as the character of his previous work, will be duly considered by the Board in making its recommendations.

10. The Board will make sufficient inquiry to ascertain that the applicants recommended are fit for the work; that they have enough education to make the required reports, estimates and calculations; that they are of reputable character, and of sober and industrious habits; and that they have not been convicted of crime or misdemeanor.

11. At the close of the examination the Board will make a report, through the Commandant, to the Secretary of the Navy, showing the comparative merit of the applicants for the vacancy, and designating the name of the individual who, in its opinion, is best qualified for the place. If the Board reports none of the candidates for the position as qualified, a new examination will be held, and the position will remain open until a qualified candidate is secured. The record of proceedings of the Board, with all applications, certificates and other papers, will be filed in the office of the Commandant.

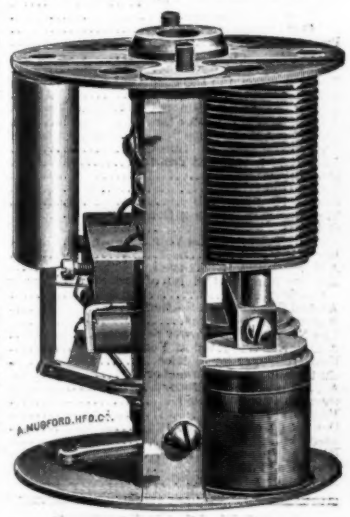


FIG. 4.—WORKS OF WATERHOUSE BROS. ARC LAMP, ¼ SIZE.

A Good Contract.

The Waddell-Entz Electric Company, of this city, has secured the contract for the complete generator and motor equipment for the new building of the *Mail and Express*. This plant, which will embody all the recent improvements in electrical machine design, will comprise 300 horse-power in generators and 19 motors from 40 horse-power down. The generators will be direct coupled. Four 75 horse-power horizontal engines will be used.

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THE ELECTRIC LIGHT AND OUTDOOR PASTIMES.

The after dark exhibitions of the United States Horse and Cattle Show Association, which have been held during the past week at the grounds of the Manhattan Athletic Club, New York, remind us of the important part electricity plays in outdoor exhibitions of all kinds given after dark. The sessions of the horse show were held during the morning, afternoon and at night. The grounds were almost as bright as day, over 70 arc lights being used to illuminate the track and paddock. Shortly after the Madison Square Garden was opened football and lacrosse matches were held in the amphitheatre by aid of the electric light. Recently it was proposed to run horse races at St. Louis at night, the track to be illuminated by arc lights, but, owing to a stricture in the pool-selling laws of Missouri, the project had to be abandoned. Such spectacles as the "Fall of Pompeii" and "Rome Under Nero" are familiar to us all, and when it is once brought to our attention we appreciate the important part which electricity performs in such exhibitions. In these times every energy is bent to lengthen the hours of pleasure and work and to narrow those of sleep. The electric light is doing more in this direction than any other one invention. We may yet see the time when our national game will be played after dark

TO A YOUNG MAN ABOUT TO ENTER COLLEGE.

To that young man who is about to finish his preparatory education and who looks forward to a college course we would address a few words. If you are not afraid of hard work, if you have moderately strong practical inclinations, if you are equipped with average brain capacity, if you have the money and the time, we would advise you to attend a good technical school, where there is an established course in electrical engineering, and fit yourself for the profession of electrical engineer. The requirements for such a calling which we have just named are not severe nor are they unusual, but they are essential. There is some mystery about electricity, but don't let that frighten you, for there is a great deal more that is not mysterious.

As between a classical education and a technical training, we emphatically advocate the latter. We could advance no more convincing argument to justify this advocacy than to refer to the graduating classes of two institution of the character named. Take, for example, the classes of 1891 turned upon the world by Harvard University and the Massachusetts Institute of Technology. Compare the number of men who are already employed; compare their relative positions; compare the number who are without situations; compare their relative fitness to secure positions. In this democratic country and in these practical times the man who knows a trade or an engineering profession has much to be proud of and nothing to be ashamed of. There is a demand for him and he need not fear the reverses of fortune. He has a capital which the fluctuations of the stock market do not affect.

Far be it from us to cry down the classical colleges—they have their places in the world. But the spirit of the day and hour compels us to pin our faith on the practical and technical institutions.

The opportunities offered to acquire an electrical education are numerous and increase every year. Electrical engineering courses are now provided which require from two to four years to complete.

The cost per year to the student ranges from $500 to $1,000. If you decide to become an electrical engineer, prepare yourself for hard work at college, secure a situation as a wireman, if nothing better offers, during the Summer vacations and at the end of your college course you will be able to demand and secure a start in the world which will be ample recompense with a high rate of interest on the cost.

THE THOMSON SCIENTIFIC CLUB.

The third annual banquet of the Thomson Scientific Club was held in their club rooms at Lynn, on Friday evening, May 13. This organization consists of electricians, experts and foremen employed at Lynn by the Thomson-Houston Electric Company, and in addition to a library, a billiard room and other accessories of a club, they have lectures or informal talks at their rooms every fortnight, and during the past year have had a course of lectures in one of the larger halls of the city.

On the occasion of the banquet the Club entertained as guests some of those who had lectured before them during the past year. After subjecting an elaborate menu, served by Caterer Dill, to the test of direct experiment, the *post-prandial* exercises began.

Lieut. J. B. Cahoon, U. S. N., now connected with the Thomson-Houston Company, first gave a statement with regard to the Club and its organization, including reference to its various methods and the scope of its work. The membership is, at present, 131, including some of the citizens of Lynn who are interested in scientific pursuits, although not in connection with the Thomson-Houston Company.

Lieut. Cahoon surrendered the leadership to Albert L. Rohrer, who served as toastmaster for the evening, calling first upon Hon. Elihu B. Hayes, Mayor of Lynn, who spoke of the industries of the city and the duties of citizenship, and referred to the cordial manner in which the city had always welcomed and advanced those who had affiliated themselves with its interests.

He was followed by E. Wilbur Rice, Jr., general superintendent of the Thomson-Houston Electric Company, who made a great many interesting statements with regard to the growth of the company and its present enormous out-put. The factories at Lynn alone have a pay roll of $2,500,000 a year. The product is sufficient to load 2,000 freight cars, and the receipts are considerably greater in volume. The production of the factory, if estimated in the electrical horse-power of the apparatus produced, is now 5,000 horse-power per week.

Rev. F. T. Hazlewood, D. D., addressed the Club on the contributions of science to the brotherhood of man. The duties of Dr. Hazlewood's calling have not stood in the way of his being one of the leading microscopists in eastern Massachusetts, and he has frequently addressed the Club on the subject of his investigations.

C. J. H. Woodbury addressed the Club upon the subject of electricity in mill lighting, the general point being that the demands for more perfect illumination for fine work, involving a proper distinction of colors, were of more importance than the mere cost of the production of such light. The cheapest light in cost of production was stated to be undoubtedly kerosene, which could be furnished in a mill using light 300 to 500 hours per year, at a cost of from 40 to 60 cents per lamp per year, including wicks and chimneys. He cited an instance of an improvement in the product in a carpet weaving mill, when the illumination was increased by the substitution of 16 c.p. incandescent lights for 10 candle-power gas lights, the amount of light being further increased by doubling the number of incandescent lamps, with a corresponding improvement in the character of the product. He read a letter from the late Sir William Siemens, giving the results of some of the investigations made by Sir William and Professor Tyndall, as to the proportion of luminous rays produced by various methods of lighting.

Mr. A. W. Ives spoke on the expert course of the Thomson Houston Company, which is a systematic method of preparing young men for entering the work of the company in responsible positions, involving the designing and operation of their electric machinery.

The last speaker of the evening was Prof. Elihu Thomson, who spoke on the future of electric lighting, giving his opinion that the possibilities of this form of illumination had been but barely entered upon. He inclined very strongly to the belief that the conductors of the future would be concentric. The rod surrounded by insulation filling a tube would be one conductor, the tube thoroughly grounded forming the other, and, for distribution purposes, the electricity would be carried at as high a potential as was possible under the conditions by which the insulation could be maintained. He related a humorous incident of a younger member of his family, who asked him, when he came home one evening, "Papa, what is the use of people, anyhow?" and applied the remark as one which must be used by children of older growth relative to every new method of study and investigation in its application to natural phenomena, maintaining that everything possesses a utility which will sooner or later be discovered by investigation. For the present and for the last few years electricity has constituted one of the highest objects for the application of the human mind, because this investigation requires the closest mental application and the results possess such characteristics of novelty. This will undoubtedly, in the course of years, be followed by some other line of investigation requiring the highest application of human thought. What that line may be no one can tell, but it may be the question of the relations of individuals to the community or even to the government. At all events, the unsolved problems and undeveloped applications of electricity, he felt assured, were sufficient to occupy the best efforts of the human mind for this generation.

The attractions of the evening were such that the company broke up at rather a late hour for such a gathering of busy young men as form its membership. A portion of the membership of the Club is necessarily changing, as the duties of some members require them to be in various parts of the field occupied by this great company, but in such cases their places are taken by others, so that the resident membership fully holds its own. A large portion of the Club is formed of persons who are permanently engaged at the works at Lynn.

The following are the officers of the Club: President, J. B. Cahoon; vice-presidents, H. G. Reist and F. C. Bates; secretary, Franklin Sheble; treasurer, J. B. Barr; librarian, E. D. Preist; reviewers, H. G. Reist, J. E. Randall and H. S. Rodgers.

CORRESPONDENCE.

OUR LONDON LETTER.

The New Telephone Company.—A company under this title are now canvassing London. They offer to the London subscribers trunk line communication with Manchester, Liverpool, Glasgow, and all the chief commercial towns in Great Britain. The rate fixed up at present is an inclusive annual charge of £14, but the first 5,000 connections, for which agreements are signed, will be accepted at 12 guineas. These rates are for lines not longer than one mile from the nearest exchange; longer lines will be taxed in proportion to their length at half the initial charge per mile. The metropolitan area, however, will be so laid out that lines exceeding one mile in length will be very exceptional.

It would, perhaps, be difficult to explain why the use of the telephone is so limited in London, and why it barely exists in only a few of our provincial towns. Some excuse, however, may be found for the refusal of the government to allow telephone companies independent action from a disclosure in the late budget concerning its operation in Scotland. There, especially in Glasgow, the telephone has largely superseded the telegraph, to the extent that the revenue from telegrams in Scotland during the past year is reduced by £1,200.

The Progress of Electric Lighting in the City of London, during the year 1891, is shown in a report submitted this week by Colonel Haywood to the commissioners of sewers. Towards the close of 1890 the contracts were assigned to the Brush and Laing-Wharton companies. In January, 1891, a main junction box was, by the sanction of the commissioners, set up in Walbrook, and on February 3 the work was formally inaugurated by the lord mayor. At the end of 1891, the Brush Company had established a central station at Meredith's Wharf and laid their mains in Queen Victoria street, Cannon street, St. Paul's Churchyard, Queen street, Walbrook and Mansion House place. By June, they had lighted 25 lamp columns, which were so satisfactory that in September the gas was finally discontinued. At the end of 1891 the Laing, Wharton and Down syndicate had laid mains in Lower Thames street, Arthur street east, King William street, Cornhill, Gracechurch street and Lombard street. Before the year expired 25 posts were erected, and on January 6, 1892, these streets were permanently lighted with so much satisfaction to the public that gaslight has almost disappeared. In August the contracts were transferred to the City of London Electric Lighting Company, who are vigorously carrying on the work and extending their mains in every direction. FRENCH.

London, May 7.

OUR SEATTLE LETTER.

The Tacoma Railway and Motor Company has increased its capital stock from $500,000 to $750,000.

A $10,000 Electric Light Plant will be put in the headquarters' building of the Northern Pacific Railroad at Tacoma.

L. J. Tibbits, formerly connected with the West Street Electric Road, of Seattle, has been appointed superintendent of the Tacoma Railway and Motor Company.

The Olympia Light and Power Company has purchased the Olympia Railway Company's line. The consolidation does away with a threatened conflict for the possession of certain streets.

Chin Hung, a Chinaman, has secured a verdict for $50 against the Rainier Power and Railway Company, of this city, for injuries sustained while he was a passenger on the line. He was kicked from a car by a drunken man.

The Plant of the Fidalgo City and Anacortes Electric Railroad Company has been seized by the Northwest Thomson-Houston Company, which originally supplied the equipment. This action was caused by the road's failure to pay for its plant.

It is Quite Possible that both steam and electricity will be used as motive power on the Everett and Monte Cristo Railroad. Steam locomotives would haul the ore from the mines and electricity would be employed for the passenger traffic around Everett.

Contracts Have Been Let for the bridges on the Snohomish and Everett electric road, and the work of grading will soon begin. The line will be nine miles long. There is some talk of obtaining power from an electric plant to be erected at Granite Falls, 10 miles distant from the line.

The Seattle General Electric Company has won in a suit brought against it by W. S. Leckie & Company for $37,025 damages. Leckie claimed that his stock of dry-goods was injured to that extent by a fire in his store, caused a year ago by the electric light wires, which he alleged were not properly put in.

During the First Week of this Month the employés of the Tacoma Railway and Motor Company struck to enforce their objection to the new schedule of pay by the hour. The company finally granted a concession that the total pay-roll for the month should not fall below that of the month preceding; if it did, the surplus should be distributed *pro rata* among the men. On these terms work was resumed.

A Plan is on Foot for building an electric road 10 or 12 miles long from Gilman, a coal mining village to Lake Washington, which forms the western boundary of this city. The road will greatly shorten the distance between this city and Gilman; and, running through an agricultural country, would have considerable traffic in market products. The line would have easy grades, none exceeding 1½ per cent.

The Construction of the Rainier Power and Railway Company's Electric Line into the heart of the city has begun, and will be pushed to immediate completion. The managers of the road hope to be done by the first of August. The track will be of 45 pound girder rails, laid on stringers. Two large generators will be added to the plant at the western mill to supply the power needed. Edison electrical equipments have been ordered for six new cars, and these, with the two already in use, will enable the company to give a ten minute service. The company will also build an extension north to a suburb known as Yesler. H. L.

Seattle, Wash., May 7.

OUR SAN FRANCISCO LETTER.

A Fight is being made by the electric and cable roads of Oakland for right of way down Washington street to the water front.

Visalia, Cal., will soon be lighted by electricity. At an election recently held it was decided to issue bonds for a municipal lighting plant.

It is Expected that by July 1 Eureka, Cal., will be supplied with an incandescent lighting plant. The San Francisco Gaslight Company, who own the plant, state that the Westinghouse alternating system will be used.

The American Society of Mechanical Engineers convenes in this city on May 16, remaining in session three days. A large local committee has been selected to assist in the entertainment of the distinguished guests.

Cars Are Now Running over the Oakland, Haywards and San Leandro Electric Road. The road was equipped by the Thomson-Houston Company, and the 12 cars came from the shops of Carter Brothers, at Newark, Cal.

The Redding Electric Light Company proposes utilizing the power of the Sacramento river that flows to waste by that town for lighting purposes. The company expects to be able to generate from 500 to 1,000 horse-power through the agency of the immense fall. Twenty thousand dollars has been invested.

Mr. Geo. P. Low, electrical expert for the Pacific Insurance Union, has designed a transformer for medical practitioners. The transformer gives nearly every current known to the medical profession, and can be operated from any arc, incandescent, alternating, electric railway or other circuit. Mr. Low has applied for a patent.

The Fresno Electric Street Railway Company has at last been granted a 50 year franchise for its lines in that city, but it necessitated a hard fight on the part of the company. The City Council had introduced two amendments, one stipulating that after the next ten years two per cent. of the net earnings should be paid into the city treasury, and the other fixing the fare at five cents through the city and additions. These amendments were lost and the ordinance passed.

The Edison Light and Power Company, this city, has commenced placing wires underground. Ground was broken for the system last week at the junction of Montgomery and Post streets. Three inch pipe is being laid in which is incased three wires. At present only the wires supplying the business houses with incandescent lighting will be buried, but eventually cement conduits will be laid above these pipes, in which will be contained the wires connected with the arc system. It is the intention of the company to bury all wires in the near future. When they do this, and the telephone company finish burying their wires, about the only aerial obstructions remaining will be the wires of the telegraph companies.

A Recent Issue of the San Diego, Cal., *Daily Union* contains the following: "W. V. Lockwood, of the Electrical Engineering Company, of San Francisco, has been in this city for the last few days quietly investigating water supply, with a view of ascertaining its horse-power capacity. The idea of the company is to secure a power of sufficient capacity to operate an electric light plant which will generate a power ample to light the city, and also for manufacturing purposes and to operate an electric street railway. He paid a visit to the stand pipe, ten miles east of the city, and made a note of the power. He refused to make public the result of his investigations, and left for San Francisco." Your correspondent called at the office of the Electric Engineering Company, but found that Mr. Lockwood had not, as yet, returned.

After Overcoming the strenuous opposition made by the Legislature, Board of Supervisors, property owners and the press, the San Francisco and San Mateo—the pioneer electric railway of San Francisco—has been completed, the formal opening taking place on April 26. Eight cars loaded with officials of the road, prominent citizens and representatives of the press, were started from the junction of Market and Stuart streets at 10.30 o'clock. The trip was a very satisfactory one, everything working to perfection. The grades were ascended with apparent ease, and minus the jerking which attends the San Francisco cable cars. The steepest grade is the Guerrero street, which is 11½ per cent. The road is now completed as far as Holy Cross cemetery, and here a short stop was made. On the return trip the company's power house at Sunnyside was visited. A welcomed repast here awaited the guests, after which all were conducted into the car house, where a temporary platform had been erected for the accommodation of the speakers and officials. In the remarks made by prominent citizens, supervisors and others, much praise was given to the gentlemen who had invested their capital in an enterprise which had met such opposition and been viewed with incredulity by many local capitalists.

The road, at present 10 miles in length, was equipped by the Thomson Houston Company. Much credit is due to F. F. Barbour, the company's engineer, for the success which marked the opening of the road. Thirty cars are now in use, 15 being equipped with two 15 horse-power motors and 15 with two 25 horse-power motors. Six Thomson-Houston generators furnish the power. Each generator is of 110 horse-power and capable of generating a current of 80 kilowatts. J. R. K.

San Francisco, May 14.

OUR BOSTON LETTER.

The Porter-Leavitt Manufacturing Company, of Providence, R. I., has removed its factory and offices from Laurel to Mitchell street, same city.

Messrs. H. L. Slade & Company, successors to Kendall & Slade, this city, will continue in the same line of business at the old stand, No. 184 Congress street.

Messrs. Legg, Hobbs & Company (Mr. Geo. L. Allen), bankers and brokers, have taken commodious offices in the Exchange Building, this city, where they will be pleased to meet their numerous electrical friends.

Messrs. M. K. Kendall & Company, formerly with Kendall & Slade, have established offices in the Vulcan Building, No 8 Oliver street, this city, where they will engage in the same line of business as that formerly conducted by the old firm.

Mr. Hollis French, the well-known electrical engineer, who has been identified with electrical industries abroad during the past year, recently returned to his home in this city. Mr. French has become associated with the Massachusetts Electrical Engineering Company, this city.

Mr. Charles W. Holden, a well-known and successful insurance agent of this city, was tendered a banquet by his employés, Monday evening, May 2, at Young's Hotel. It was an enjoyable occasion. Mr. Holden had returned home on the previous Saturday, after an absence of nearly two months, during which time—accompanied by his wife and daughter—he visited most of the places of interest on the Pacific Slope.

New Rules and Regulations have been adopted by the Board of Fire Underwriters for the installation of electric lighting and power apparatus. This new code of rules is based, no doubt, on that adopted by the National Electric Association, the National Electric Insurance Bureau, the North Western Fire Underwriter's Association, and the Philadelphia and New York boards, and which is in general use throughout the South. The rules are enlarged so that "only non combustible insulating material will be approved for supports and fastenings used in the installation of light and power wires." W. I. B.

Boston, May 14.

OUR CHICAGO LETTER.

Charles Ffrench, formerly European representative to ELECTRICAL REVIEW, stopped in the city this week on his way West.

T. Ahearn, of the firm of Ahearn & Soper, Ottawa, also general manager Ottawa Electric Railway, spent two days in the city this week.

The Northwest Thomson-Houston Company, St. Paul, Minn., report business in the West very encouraging, they having contracts for several new roads to equip with electricity, also some miles of extension to build.

Thos. G. Grier, who has conducted the Paiste business in the West for the past year, has been appointed Western manager for the Bryant Electric Company, of Bridgeport, Conn., with offices and store room in the Monadnock Building.

Sixteen Stories and a corresponding amount of Simplex rubber wire is George Cutter's impression of the Venetian Building, on Washington street. This is now nearly completed and is lighted throughout with incandescent lamps.

Mr. Chas. G. Armstrong, the expert on electrical matters and in the tower, is just finishing the specifications for lighting the new Athletic Club Building, on Michigan avenue. Some very pretty effects are to be produced with the lights in this structure.

The National Electric Manufacturing Company, Eau Claire, Wis., are putting up a two story brick building 100x50 feet in addition to their present factory, which, owing to large increase of business, was not of a sufficient capacity to turn out the work desired.

G. G. McDuff, for several years past connected with the electrical press, has joined the forces of the *Electrical World*, and will assist in getting out their electrical directory, which will be published soon. Mr. McDuff has many friends who wish him all success possible.

J. H. Reid has severed his connections with the Edison General Electric Company, and after May 1 will be on the staff of the Detroit Electrical Works at their Chicago office. The Chicago office force now numbers five, with L. E. Myers at the head, and occupy a suite of rooms, 917 and 918 Monadnock building, which are fitted up in elegant shape.

W. C. McKinlock, well known through his connection with the Central Electric Company, Chicago, and later as general manager of the Southern Electric Supply Company, St. Louis, has organized a new electric supply house with office and salesroom at 313 to 315 Dearborn street, Manhattan Building, Chicago, to be known as the Enterprise Electric Company. Associated with Mr. McKinlock in the new company, as incorporators, are F. P. Hill, late of the Southern Supply Company, St. Louis, and W. F. Richardson, formerly with the Central Electric Company.

The South Park Commissioners met Thursday, this week, and awarded the contract for an electric light plant at Washington Park to the Brush Electric Company. These bids were opened last Monday, and at that time the Brush Electric Company, Standard Electric Company, Western Electric Company, Fort Wayne Electric Company, Abbott Brothers and the Thomson-Houston Electric Company, appeared as competitors, each offering a number of bids, which varied in amounts with the specifications as to cables and lamps—whether single, double or triple. The district to be lighted by the new plant includes Washington Park, Grand and Drexel boulevards, and Garfield boulevard east of State street. The Brush Electric Company agrees to erect and equip a plant fully adequate to the needs for $63,250. The contract calls for double lamps and any kind of fiber cables that may be desired. A Corliss engine is to be used and probably the Babcock and Wilcox boilers. The power-house will probably be located in Washington Park, near Fifty-seventh street, but this is not definitely decided yet.

Chicago, May 14. M. J. B.

PERSONAL.

On account of the death of his mother, Mr. Nikola Tesla will not be able to appear before the American Institute of Electrical Engineers' annual meeting at Chicago next month.

Ex-Mayor Edward A. Maher, of Albany, has resigned the management of the Albany Electric and Illuminating Company to become president of the "Huckleberry" system of railroads in the annexed district of New York city.

Mr. J. J. Nate, of the Chicago Telephone Company, and his brother were visitors in New York city last week, and were welcome callers at this office. Mr. Nate and his brother expect to visit Washington and other cities on their return, both enjoying a brief relaxation from work.

Mr. William Hazelton, third, for a year or more in charge of the Philadelphia office of the Short Electric Railway Company, has been called to Cleveland, O., to take the position of assistant general manager of that company. Mr. Hazelton's well known energy and business ability will, by this change, be used in a larger and more important field, and the representatives of other electrical companies who have had reason to acknowledge him in competition with street railway men, cannot congratulate themselves that he is now out of their way—his supervision of the important Eastern territory heretofore under his control, will be as unremitting as ever. Mr. Hazelton has the REVIEW'S heartiest congratulation on his advance to a more important position.

Telephonic News

*** The Wisconsin Telephone Company's system at Racine is being rebuilt at a cost of $20,000.

*** A telephone system connecting the different railroad depots at Marshfield, Wis., has been contracted for and will be at once constructed.

*** The Southern New England Telephone Company has leased a building at Birmingham, Conn., in which to establish a new telephone exchange.

*** The Canadian Senate railway committee had sharp arguments last week over the Bell Telephone Company's bill asking power to increase its capital stock from $500,000 to $5,000,000, and to issue bonds for the amount. The committee agreed to allow the increase of capital, but limited the power of bonding to $500,000, the company's present capital.

*** A telephone exchange, having, it is now thought, about 600 instruments, will be established in the World's Fair grounds. Of this number about 25 will be toll telephones, which will be distributed conveniently about the grounds to be used by any one upon payment of a small fee; some 300 will be for exclusive use by the Exposition officials and employés; and the remainder will be for commercial purposes. The Exposition will furnish space and other accommodations for the requirements of the telephone company for office and service, and the company will put in the instruments free of cost. It is the intention of the telephone company to establish at the Exposition the best exchange in the world. Only the most perfect instruments and metallic circuits will be used. The long distance copper lines to New York will be completed by the time the Fair opens, and connections will be made directly with this line at Jackson Park, independent of the Chicago exchange. Thus, it is expected, that, through long distance telephones, exhibitors will be enabled to talk to New York, Boston or Philadelphia without difficulty.

"A Complete History."

The ELECTRICAL REVIEW, New York, has published a Decennial Number, showing ten years of electrical progress. The leading article is a review of the journal as it advanced side by side with the development of electrical science, and to-day, as formerly, is recognized as one of the leading papers in that line. The article taken as a whole is a complete history of the practical application of electricity to mechanical power, lighting and the various other uses in the industries of the age. The engravings show many modern electrical plants which contrast strangely with those of the previous ten years.—*The California Architect and Building News.*

The Aldermen and the Electric Lights.

Some time ago the 200 arc lamps ordered from the United States Company were apportioned among the aldermen, 20 to each. The aldermen thought they had a berry. They never before had had so many gifts at their disposal. But greatness brings its responsibilities. For the first week the statesmen enjoyed the visits of their constituents who wanted electric lights at their front doors. But by and by it was discovered that there wouldn't be lights enough to go round. There were perhaps 75 grips in each ward and only 40 lights. How to appease the remaining 35 grips was the question, and the aldermen agreed upon a solution yesterday. Each man put his 20 lights into a jack pot with instructions to the committee on electrical construction to divide the pot. For this disagreeable duty the committeemen will probably get a rake off, such as 10 per cent. more lights than will be awarded the constituents of the other aldermen.—*Dubuque, Ia., Telegraph.*

Edison Lead Covered Cables.

As electrical knowledge progresses and becomes more widespread, and the manufacture of electrical apparatus rises towards perfection, customers become increasingly fastidious and anxious that their requirements should not only be satisfied, but even surpassed. Fully posted as to the new developments which are now being constantly manifested, and provided with the latest measuring devices as they are invented or perfected, their demands call forth new efforts on the part of the manufacturers. This has been especially true of wires and cables. Considerable difficulty has been experienced in lowering the static capacity to the figure stipulated in the specifications of the telephone and other companies. A short time ago a figure of .20 or .21 micro-farads was considered satisfactory, but this has been decreased year by year until now .080 micro-farads is required.

Although the Edison General Electric Company have for many years past been manufacturing telephone cable, they have only recently put in the immense lead presses which now enable them to turn out complete lead covered cable. With these new facilities, their difficulties in the direction just mentioned have been overcome, and several cables lately shipped have shown a static capacity of not more than .075 micro-farads. In striving to lower the static capacity, the matter of insulation has not been neglected and a remarkably high insulation has been obtained in the case of cable which has left their works.

The one feature, however, in which the manufacturers take special pride is the lead cover. The Edison Company have adopted the process of Siemens & Halske and their presses, and use absolutely cold lead. From the slugs of lead every particle of oxide is removed before insertion in the press, and as the atmospheric pressure is increased the lead is pressed out over the cable, enclosing it in an armor impermeable either to air or water.

Cable recently supplied to the Metropolitan Telephone Company, of New York, has received unqualified approval, and, although dry core was used, the cable could be handled as well as one made with the saturated core. The uniform gauge of the cable and its smoothness were also matters of appreciative comment.

The Pacific Telephone and Telegraph Company of San Francisco recently placed a large order for this cable, the lead sheathing enclosing no less than 100 pairs of wires.

We show in the cut a corner of one of the cable shops at Schenectady with several drums of this cable awaiting shipment. The larger drums are 5 feet 16 inches in diameter by 3 feet 6 inches wide; the smaller ones 4 feet 8 inches in diameter and 3 feet 6 inches wide. Telephone companies all over the continent are now alive to the special features of the Edison telephone cable, and the Schenectady works find it a difficult task to keep abreast of the demands upon them.

Bogart's Dynamo Electric Gas Lighter.

The ingenious device illustrated on this page was invented and is manufactured exclusively by Mr. A. L. Bogart, the well known electrician, of 22 Union Square, New York city. It obviates the danger of fire from matches, and has been endorsed by fire insurance underwriters. It can be used among inflammable combustibles without the least danger, and has been adopted exclusively by many large dry goods houses and silk and cotton mills.

The highly polished vulcanite cylinder, which is held in the hand, contains a most ingenious as well as perfectly constructed dynamo generator, which is so delicately mounted that it is caused to rotate at a high speed by the simple pressure of the thumb on a button projecting from the top of the cylinder. Such motion of the generating parts produces a current of electricity which is carried through the insulated conducting wires, concealed from view within the metallic stem surmounting the cylinder, to its termination, at which point the wires are

FIG. 1.—BOGART'S ELECTRIC GAS LIGHTER, STYLE A.

slightly separated, across which the current leaps, producing a succession of innumerable sparks which ignite the gas.

The lighter is made in two styles, that shown in Fig. 1 having a straight tube and provided at its extremity with a clutch by which the gas cock may be turned on or off, and a slotted-cone gas receiver containing the spark electrodes. The form shown in Fig. 2 is intended for use with fixtures where no globes are employed or where the globes have very small or closed holders.

*** Richard Croker is building a through telephone line from New York to his stock farm at Richfield Springs, N. Y.

A Big Electric Railway Deal.

A dispatch from Seattle, Wash., says that a big deal is on for the control of all the electric railways in that city by the Northwest Thomson-Houston Electric Company. It is understood that the West street and North End, the Consolidated Electric, Rainier Avenue, Grant street, Union Trunk lines and the Rainier Power and Railway Company, have agreed to sell their lines, aggregating over 50 miles, and worth $3,000,000. The parties to the scheme refuse to talk, and Mr. Byllesby, president of the Thomson-Houston Company, denies the deal, but it is certainly under negotiation. It is understood the new company will be organized, take up the bonds of the old company and issue new blanket bonds for $1,500,000. It will abolish all old power houses, except the one from which the power to all the lines will be supplied, and put all under one management. The taking up of these bonds will release about $1,000,000 now tied up in the bonds of the old companies.

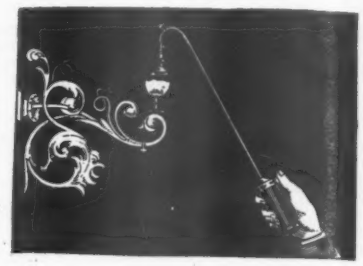
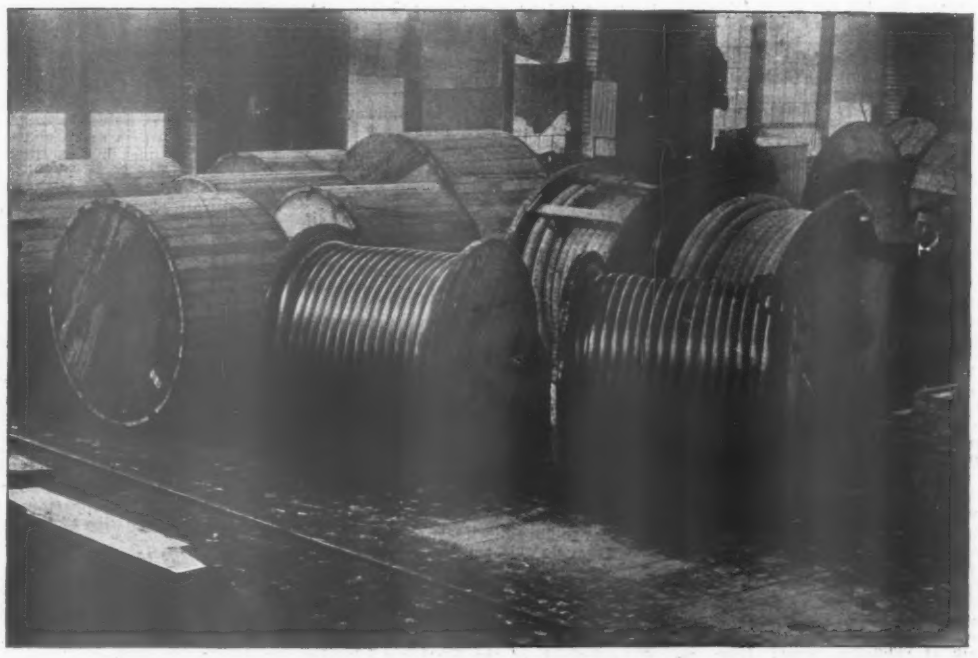


FIG. 2.—BOGART'S ELECTRIC GAS LIGHTER, STYLE B.

The "New Hampshire."

A trial trip of the beautiful steel steamer "New Hampshire" was made with a large party of invited guests on May 7. This vessel will be used by the Providence and Stonington Steamship Company as a twin to the "Maine." The boat is equipped with every convenience for high-class passenger traffic. Its appointments are perfect. It is screw propelled, built of steel, and is divided by steel bulkheads into seven watertight compartments, insuring perfect safety in case of accidents. The main saloon is a magnificent apartment 243 feet long, the walls being in cream and gilt and the ceiling domed. The carpets and furniture are in delicate tints. The staterooms opening from the main saloon are larger than is usual on Sound steamers, and are neat and comfortable. The engine has four triple expansion cylinders, 28, 45, 51 and 51 inch diameter, and 42 in stroke. The propeller is 13½ feet in diameter. Four Scotch type boilers are installed on each vessel, working at a pressure of 160 pounds to the square inch. Blowers are provided to furnish forced draught when extra speed is needed. On the trial trip an average speed of 18½ miles per hour was made. This steamer is lighted by 600 incandescent lamps. A Thomson-Houston dynamo is operated by a Brotherhood engine supplied through a reduction valve from the boilers. There is an annunciator service from every stateroom.



TELEPHONE CABLES AT THE SCHENECTADY WORKS OF THE EDISON GENERAL ELECTRIC COMPANY.

The Varley Electric Time Call.

This instrument is designed as a labor-saving apparatus, and to make absolute calls and service in hotels, livery stables and other places in which it is desired to give prompt attention and security to customers.

It had its inception in the mind of the inventor through a long wait on a line of guests in front of a hotel clerk, when he was anxious to retire, having arrived on a late train with a number of others. The slowness of the old method of handling things was very forcibly impressed upon him. Almost all expressed a desire to be called or have attention at some particular time, and the clerk was kept writing these instructions in his blotter, while the tired guests toward the end of the line kept getting more impatient as the moments went by. As a labor-saving machine it lessens the work of the clerk very materially.

Under the method generally in vogue the calls are recorded on a slate, from which they are copied by a night clerk and given

FIG. 1.—CHECK FOR VARLEY'S TIME CALL.

to a porter. Errors not infrequently result in copying or transferring the room numbers. In some cases elaborate call systems are installed, having call bells placed in the various rooms of the house. This system has the objection, however, that the ringing of a bell not only awakens the guest who desired to be awakened, but his neighbor also, who does not wished to be aroused. The Varley apparatus is a completely self-contained piece of apparatus.

The general arrangement of the call is shown in Fig. 2. Beneath the clock are the pins arranged in line with the hour, quarter, half and three-quarter hour lines. When a guest desires to be called at 5.45 A. M. the clerk takes the tag, Fig 1, numbered in accordance with his room, from the key-board, slips it over the two metal pins under the figure "45" and to the right of the figure "5," these two forming the hour for call. Nothing further is required until the clock reaches the time of 5.45, when the bell will ring, and continue to ring until the tag is removed. This tells at once the room to be called, and there is no possibility of mistake if there is any one about to hear the bell.

When ten guests are to be called at the same time, ten little room-tags are placed on pins in the same manner as one.

The dark portions of the board represent night, and the light portions day.

The multiplicity of its uses has been demonstrated in hotels in which it has been placed, in and about New York. In all cases in which the clerk has heretofore put memoranda on slate or blotter, the machine comes into play. One party desires ice water, another cigars, a third tells the clerk he is going out and to inform any callers he will be back at a certain hour, a fourth desires a cab, etc., etc. The alarm sounding tells that some one desires attention; the clock gives the time, and the check tells who requires service, and what that service is. For trains, the ordinary method is simply to put on a check, and for other service a memorandum is written upon it.

In some cases the instrument will be put in a position where it will be accessible to the guests so that they may themselves place the checks in position, a number of checks being in such cases detachably mounted upon the room key, or in cases where it is preferred to have the clerk attend to this work a checkboard is furnished with hooks for containing the room checks. The instrument is provided with a push button, as indicated, by which the bell circuit may be closed and the bell used as a porter call by the clerk. The instrument is efficiently operated by two cells of dry battery and takes up very little room, being only 28 inches high, 18¼ inches in width and 6 inches in depth. It is manufactured and sold by J. Jones & Son, Vesey street, New York.

The device has been found very useful where systems having room bells have been already installed by serving as a faithful reminder to the clerk of his duty. It is designed to provide for a system of special calls by having silicate tags with metal body arranged so that the want may be written directly upon the tag. The circuit closing arm is mounted so that the clock may be set without disturbing the proper position of the circuit closing mechanism or upsetting its adjustment.

Edison Suit Begun at Trenton.

There was a miscellaneous collection of electrical appliances in the United States Circuit Court room at Trenton, N. J., on May 9, when the case of the Edison Electric Light Company against Westinghouse, Church, Kerr & Company, for infringement of patents began. The case will occupy at least 10 days, and will be argued by the respective counsel without a jury.

On a long table was a miniature plant of electric light wires and poles, showing the central station of the plant in the rear of Dunn's hardware store, on East State street. Several of Trenton's streets are shown. In order to bring their case more before the court, the complaining company stated that the defendants had erected a plant in Trenton embodying the principal features embraced in their patents. It was for this purpose that the local station was exhibited.

The complainants state that on August 9, 1880, Thomas A. Edison applied for a patent for a certain new and useful improvement in electric distribution and translation systems, which was not known or patented in this or any foreign country more than two years prior to his application; that Edison, on June 21, 1881, assigned to the complainants all right, title and interest whatever in and to such improvement.

These letters patent, together with other letters patent owned by the complainants, cover and protect to it the essential features of and inventions employed in what are known as "central station incandescent electric light plants, consisting of stations or buildings containing said machinery, apparatus and devices as are necessary to the generation or regulation of the electric current, conductors to carry such currents to the lamps, or other translating devices utilizing it for light, heat or power together."

The Edison Company claim that the defendants knew well that they, the complainants, controlled letters patent No. 264,642, which refers to the present suit, but acting with the Westinghouse Electric Company, a corporation organized and existing under the laws of Pennsylvania, erected and sold, and caused to be erected and sold, and they say they intend to sell and use "central incandescent electric light plants," embodying improvements covered by the Edison patent. Infringements have been made, the bill of complaint reads, in "this district of New Jersey and elsewhere." Also, that the defendants advertised that they would install, equip and erect such stations, and owing to such infringements they have suffered a loss and great injury.

The complainants ask for a preliminary injunction restraining the defendants from further infringements, and also that they pay to them all gains and profits resulting from such infringements.

GENERAL NOTES.

Mr. H. C. Adams, New York agent for the Fort Wayne Electric Company, is informing his friends, by neatly printed postal cards, that his office has been removed to 42 and 44 Broad street.

FIG. 2.—VARLEY'S TIME CALL.

The work on the new building for the Eddy Electric Manufacturing Company, at Windsor, Conn., is progressing rapidly, and things are lively about the place. The company will use oil for fuel under its boilers.

The Electric Engineering and Supply Company, of Syracuse, N. Y., has removed its New York office from 18 Cortlandt street to 126 Liberty street, where Manager F. C. Timpson will have larger and better quarters.

The Railway Equipment Company, W. R. Mason, general manager, during the fitting up of its new and permanent quarters, will have its office and storerooms at 11 Adams street, Chicago, which location is well known as the former headquarters of the Electric Merchandise Company.

Henry L. Gardiner has filed a petition asking that the Barrett storage battery company, of Springfield, Mass., be placed in insolvency as he is unable to collect $183 due for personal services and an attachment has been placed on the company's effects by the Revere Rubber Company. A hearing will be given by the insolvency court June 10.

TELEGRAPHIC

.... The Atlantic Postal Telegraph Company has elected these directors: James Donnelly, George G. Glenn and Charles C. Adams.

.... Dynamos will be substituted for 1,400 batteries in the New Haven, Conn., office of the Western Union Telegraph Company.

.... Overhead wires are being put underground in Atlanta, Ga., and a system of electrical subways is under discussion in Wheeling, W. Va.

.... An ordinance has been adopted in the city of Buffalo requiring all telegraph, telephone and electric lighting poles on certain streets to be removed and put underground within six months, with heavy penalties for a failure to comply with its terms.

.... E. P. Wright, for many years district superintendent of the Western Union Telegraph Company, at Cleveland, Ohio, has resigned, owing to ill-health. He will be succeeded, June 1, by C. C. Corbett, who has been assistant-superintendent at Detroit. Mr. Corbett's future headquarters will be in Cleveland.

.... The celerity of telegraphic communications was well demonstrated during the recent Oxford-Cambridge boat-race. The press boat, as it steamed up the river, paid out a cable during its entire course, and at every point in the race the news was immediately flashed, by means of this line, direct to London.

Seattle Electric Club.

An electric club is in process of formation at Seattle, Wash. Mr. Albert Bryan and others are interested in the project.

The Electrical Forging Company.

Advices have been received that the Electrical Forging Company, of Boston, will have issued to it, on May 17, 21 patents in the line of electrical heating and forging. This is in addition to the 30 patents the company already has, as well as 35 patent applications pending.

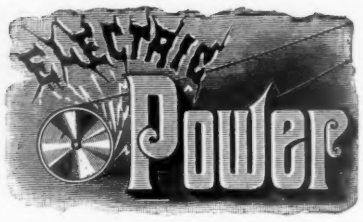
OBITUARY.

W. W. Le Grand, an inventor of electrical signaling apparatus for railroads, died at Louisville, Ky., on May 4.

John G. Kihm, manager of the Western Union Telegraph Company's offices at Castle Garden, the Barge Office and Ellis Island, died May 11, at his home, 53 Ravine avenue, Jersey City Heights. He had suffered for months from bronchial troubles. He was 41 years old and leaves a wife and four children. Mr. Kihm was an expert linguist, and was able to converse with almost all of the various immigrants with whom he came in contact.

Electric Cranes at the World's Fair.

Visitors to Machinery Hall, at the World's Fair, will be enabled to pass from one end of the building to the other at an elevation, and thus gain a bird's-eye view of the vast area of exhibits, and to see many of the larger exhibits to much greater advantage than will be possible from the floor. To accomplish this three mammoth electric traveling cranes will be constructed, each with a lifting and carrying capacity of 40,000 pounds. Contracts for their construction have been let to the Yale & Towne Manufacturing Company, of Stamford, Conn., the Morgan Engineering Company, of Alliance, Ohio, and the Edge Moor Bridge Works, of Wilmington, Del. Previous to the opening of the Exposition these cranes will be used for the moving of heavy exhibits; afterwards they will be covered with broad platforms capable of carrying several hundred people at each trip to and fro in the building.



* * The managers of the Belle City Street Railway Company, at Racine, Wis., have completed arrangements for putting in electricity as motive power.

* * At the last meeting of the Port Richmond, Staten Island, village trustees, Erastus Wiman was granted permission to construct, operate and maintain an electric railroad along Richmond avenue in the village. Work will be begun within 30 days, and in 60 days thereafter the road will be finished.

* * In prosecuting the work incident to the extension of its electric service, the West End Street Railway Company, of Boston, is building 250 channel iron four wheel trucks for the 18 foot open cars, and 50 radial trucks for 20 and 25 foot cars. These trucks are all to be of a design worked out by Chief Engineer Pierson.

* * The Shaw Electric Crane Company, of Muskegon, Mich., through its New York agents, Manning, Maxwell & Moore, has just installed two electric traveling cranes of 30,000 pounds capacity each, in the foundry building at the Brooklyn Navy Yard. They will be used in handling armor plates and heavy ship castings.

* * The electric current is, it is said, in successful use at the gun factory of St. Etienne, France, for tempering springs. The latter consist of steel wire wound spirally, and a current of 23 amperes at 45 volts is passed through. Rapid heating results, and when the required temperature has been reached the circuit is broken and the springs fall into a trough of water. One workmen, it is said, can temper 2,400 springs per day by this method.

* * The proposition of the Thomson-Houston Electric Company, to run trains through the Belt Railroad Company's tunnel in Baltimore by electric motors, was accepted by the latter company, and the details of the necessary contracts have been made. The electric company agrees to build the power house, equip it with the necessary machinery for generating electricity, and to supply the motors for hauling trains. They will give the railroad company ample time to make a thorough test, and, if not satisfactory, the electric company will remove all its appliances without cost to the railroad company.

* * George W. Mansfield and F. O. Blackwell, experts of the Thomson-Houston Motor Company, testified last week before the New York Rapid Transit Commissioners to the practicability of running trains on the proposed road by electricity at the maximum speed required of 60 miles per hour. The company, they said, was ready to submit a guaranteed bid for the construction of the motors within 10 days from the time it should be notified that they were wanted. They declared that the company could produce a 60-ton motor that could draw 40 cars of the ordinary elevated road type 60 miles an hour without danger of burning out or other trouble.

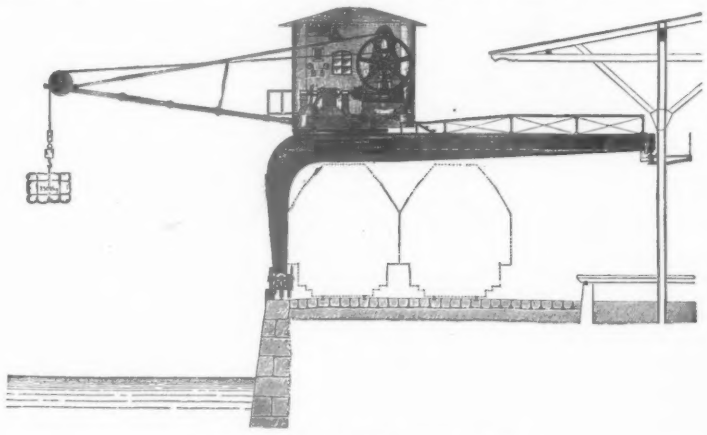
* * An electric railway, on the Abt system, is now approaching completion in Savoy, France. The line starts from Etrembières, on the Bellegarde and Annecy Railway, and runs in a circular sweep through Monnetier to Veyrier, a branch being run up the Grande Salève. The gradients range from 16 per cent. to 35 per cent., with curves ranging from 165 feet to 115 feet radius. The generating plant comprises three 165-unit Thury dynamos, coupled to turbines. The motors are four-pole, each car being provided with two 33 horse-power motors and two sets of gearing. Along the track inverted Vignole rails, supported on iron posts and brackets, form the electric conductor. A 15 per cent. loss on the line is allowed for.

A German Electric Traveling Crane.

The uses of electric motors are gradually extending. The illustration on this page, for which we are indebted to London *Industries*, shows a traveling crane in use at the Harbor Quays in Hamburg. It is built by the Allgemeine Elektricitäts Gesellschaft, of Berlin. This crane has been working satisfactorily since November last, and in all kinds of bad weather.

The particulars of this crane are as follows: Safe load, 2½ tons; total height of lift, 45 feet; arm of jib—that is, distance from load to center of crane measured horizontally—35 feet; hoisting speed, 200 feet per minute; traversing speed, 400 feet per minute.

In the construction of the crane wire rope instead of chain is used, and in the winding gear toothed wheels are avoided, so as to secure silent running. The handling of the crane is, as far as possible, like that of hydraulic or steam cranes, in which it is possible to raise or lower the load during the traversing of the crane. The travel of the crane is effected by means of a motor, which drives one of the three guide-wheels under the turn-table by worm gearing. The worm spindle can be stopped at any moment by a powerful brake actuated by the steering lever when it is in its middle position; thus the turning motion is controlled with precision. To obviate all liability of damage to the spindles from the inertia of the armatures, a so-called "wire brush coupling" is used. This acts when the brake is applied, permitting the coupled parts to glide past each other, and allowing the armature to run on for a few revolutions. The 40 horse-power motor working the hoisting gear is shunt-wound, and connected, like the other, by means of a wire brush coupling to a worm spindle, which has also a powerful brake actuated by its respective controlling lever. The reversal of the direction of motion is effected by reversing the armature current, the starting resistance being switched off by the movement of the controlling lever. Thus in its middle position the lever entirely cuts the motor circuit. To provide against accidents a second electric brake is furnished, which guards against any possible accident. Alongside the hoisting drum, round which the wire rope is coiled, and connected to it, is a brake wheel, whose brake blocks are so weighted that they would be permanently pressed against the brake-disk if they were not held free by a powerful electro-magnet. On any interruption of the main current this electro-magnet drops the blocks and grips the whole hoisting gear.



A German Electric Traveling Crane.

* * The street railway at Cheboygan, Mich., will be extended to Bay City.

* * An electric power plant will be installed at Defiance, Colo., by Denver parties.

* * The Bellingham Bay electric street railway has suspended business for two months, upon permission of the New Whatcom, Wash., council; while the sewerage system is being put in on Holly and Thirteenth streets. The track will then be relaid with steel rails.

Erastus Wiman's Opinion of Brooklyn's Electric Roads.

In an address delivered by Erastus Wiman, before the Brooklyn Real Estate Exchange, this able advocate of progress spoke as follows of the proposed electric roads in the City of Churches:

But, vast as may have been the benefits to Brooklyn by the construction of the elevated roads, the advantages will not exceed those which will come from the substitution of electricity for horses in the street railways, and with the expansion which this subtle current will render possible into all the outlying regions. In no department of human activity, in the last five years, has there been a greater gain than in the application of electricity to traction on the one hand, and the enhancement of values in real estate, by that application, on the other. The cheapness of construction, the frequency of service, the rapidity of movement and the economy of operation, are all elements in favor of electrical power; and though it may be that there are objections to the trolley system, and that in time a substitution will be found for the overhead wire, nevertheless, the whole city of Brooklyn is to be greatly congratulated that, at last, by the aid of this device, so vast a change impends in her means of comm nication. It may safely be predicted that no event in the history of Brooklyn, except the construction of its bridge, will have a greater effect than the introduction of electricity into the streets and outlying suburbs of this great city. A rapidity of movement is certain and a greater frequency of service, cleanliness and healthfulness are sure to follow in the train of the electric road. So that, with a widened area, reachable in all directions, with means of communication by the elevated and electric roads of the best character, and with a most attractive region into which new settlements must penetrate, there seems to be an abundant future, so far as physical features are concerned, for this great city.

An Old Subway Suit Settled.

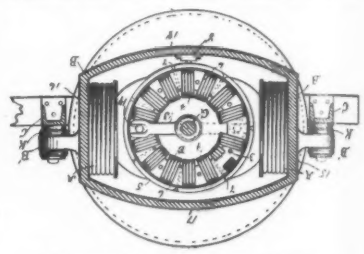
The United States Supreme Court, on May 2, affirmed the judgment by which the Court of Common Pleas, of New York, refused to grant the New York Electric Lines Company a mandamus to compel Rollin M. Squire, then Commissioner of Public Works of New York city, to give the company a permit to make an excavation in the streets for the purpose of laying underground wires.

An act of the New York legislature authorized the company to construct lines along the public highways, and in April, 1883, the Common Council of New York gave the company permission to lay its wires through the streets of the city. The company filed a map of its proposed location in accordance with the requirements of the city ordinance, but took no steps toward laying its wires until July, 1886, when it applied to Commissioner Squire for a permit to make excavations. In the meantime, the act creating the New York Electric Subway Commission had been passed, and to this commission was given authority to approve all plans for underground conduits, and the permit was accordingly refused the New York Electric Lines Company.

The company made the claim that, as it had accepted the franchise granted it, the refusal to give it a permit under that act constituted an impairment of the obligation of its contract. The court, in an opinion by Justice Lamar, read by Justice Blatchford, Mr. Lamar being ill, holds that the contention is not well founded.

A New Gearless Motor.

A novel departure in gearless motors is made by Sidney H. Short in a patent recently issued. The armature has no shaft, properly speaking, fixed to it, but revolves in mechanical contact with the field magnet poles and finds its bearings therein. Connection with the car axle is made by means of crank arms rigidly secured to the car axle, but forked at their outer ends so as to form a yoke which straddles pins fixed in the armature. The construction will be understood from the accompanying engraving, wherein the armature is shown as composed of a laminated Pacinotti core covered with a ring winding and surrounded by a metallic shell, which is supported between the field magnet poles and adapted to rotate therein. G represents the car axle, from which extends a crank arm 13, forked at its end and surrounding a pin 14 mounted in the armature core. A similar crank arm is provided at the other end of the armature. It will thus be seen that the armature is supported by the field magnet cores, and that the whole motor, field magnet and armature, is supported upon the car frame, spring buffers K K being used to permit elasticity. The armature can thus play up and down around the car axle, the forked crank arm permitting such movement, and the motor does not pound upon the rails of the track as in systems where the armature is rigidly mounted upon the car axle. The commutator is supported on pins projecting from the armature core, and the brushes are mounted upon heads secured to the field magnet frame.



Short's New Gearless Motor.

The Niagara Falls Power Scheme.

Prof. George Forbes, the celebrated electrical engineer and expert, of London, England, went to Niagara Falls last week with Edward D. Adams, president; Edward A. Wickes, vice-president, and William B. Roulaine, secretary-treasurer, of the Cataract Construction Company, of New York. Professor Forbes has devised a plan for the transmission of electrical energy from the Falls to Buffalo by use of the alternating current.

Work on the tunnel is progressing rapidly. Between 800 and 900 feet of the bricking has been put in. The bottoming-out is done only as the brick is laid. The stone taken out is used to fill in back of the bricks. The beautiful design for the portal of the tunnel has been accepted It was made by the celebrated American artist, Frederick MacMonnies, and was exhibited at the Paris Salon. It secured most favorable mention. It will be the seal to the portal of the tunnel and be carved in the stone of the keystone. The design will be a representation of the "Father of the Great Waters"—an Indian chief.

A New Electric Road at Yonkers.

The Yonkers, N. Y., electric railroad was opened for general traffic Monday, May 2, and cars have been running ever since that time continuously, giving universal satisfaction by their smooth and noiseless working. The station is fitted out with the most improved apparatus, including two Edison 100 kilowatt generators, directly belted to high speed Ball engines. The car motors are gearless 20 horse-power motors of the Eickemeyer Field system, which directly drive both car axles by means of parallel rods from the slow speed motor. This road is of special interest, as no new and heavier rails have been laid, but the old horse car rails, which had served for many years, have been left undisturbed and have only been bonded, because in this type of gearless motors the whole motor weight rests upon the car springs, and the blow given to the rails by the momentum of the motor is avoided.

New McCreary Specialties.

The McCreary Electric Specialty Company, 136 Liberty street, New York, have recently produced among others the two specialties illustrated herewith. In Fig. 1 is shown a portable electric lamp stand with a flexible arm. Each stand is fitted with an "Almond" flexible arm enabling the user to place the light in any position. The lamp is equipped with McCreary's aluminum half shade, which can be moved around the lamp at will, throwing the light in any direction. A complete portable lamp stand is fitted with socket, attachment, plug, 12 feet of silk cord, shadeholder and aluminum half shade, ready for use.

In reply to many requests from the trade, the McCreary Company has designed and

Fig. 1.—McCreary Portable Lamp Stand with Flexible Arm.

made up the three-light ceiling fixture for reflectors and half shades shown in Fig. 2. The McCreary reflectors for 16, 32 or 50 candle power lamps can be used on the center socket, and McCreary half shades of silver, opal, crystal or any color, may be used on the side lights. By this arrangement an excellent diffusion of light is obtained. The side lights give all the ceiling and side light required, while the reflector throws down all its light upon whatever may be beneath it. The whole arrangement is ornamental and inexpensive. It makes a very attractive fixture for store windows and small rooms with low ceilings, under church and theatre galleries, etc. It is also well adapted for a steamer fixture. Although it is made for a close ceiling fixture, it can be placed at any height by using a small brass rod of the required length. These fixtures can also be made for 4, 6, 8 and 10 lights.

Cutter's Conduit Connector.

With the spread of underground arc circuits it has become more necessary to have means of testing these lines, or rather every section of these circuits, in order to keep them in proper order. The conveniently placed manhole gives ready access to the cables, so all that is needed is a means of disconnecting the various portions of the series circuit. This need led to the making of Cutter's conduit connector, which we illustrate in its latest form. The cut shows how the ends of the two lead-covered cables are soldered into metal terminals imbedded in hard rubber. A metal screw-cap makes the connection between these two terminals when in place, and opens the circuit when it is removed. This screw is covered by an insulated and waterproof cap which seals the device, the brass shell being soldered to the lead covering on the cable. The construction of this latest form allows it to be wired up very quickly, and many months of experience with it have shown its effectiveness. Hundreds of these conduit connectors are used in Chicago alone, and George Cutter, who is the sole maker, is busy turning out more of them.

The mammoth Ponemah mill at Taftsville, Conn., will be operated by electric power.

Commander John S. Newell, the naval inspector of electric lighting of the navy Department, came to this city from Washington last week to make arrangements for the installation of the electric light system on the Naval Academy practice ship "Bancroft." The "Bancroft" was launched at Elizabethport, N. J., on April 30, and will be ready for service in about three months.

A Thermo-Electric Motor.

A curious apparatus was recently exhibited at a meeting of the Royal Society, according to *Iron*. It is a heat engine, based upon the principle that nickel, magnetic at ordinary temperatures, becomes non-magnetic at a temperature of 572 degrees Fahr. A disk of copper is suspended by two strings so that it can swing like a pendulum. Mounted on the copper disk is a magnet which holds up a piece of nickel. An alcohol lamp placed below the disk heats the nickel until it becomes demagnetized and drops away, when the copper pendulum makes an oscillation. During this oscillation the nickel cools sufficiently to regain its magnetic character, and is caught up by the swinging magnet, only to be passed again over the lamp, which causes it again to drop, and so on, the pendulum being thus kept in motion.

German Patents in 1891.

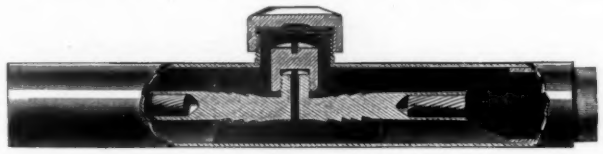
According to the *Chemiker Zeitung*, the number of patents applied for in 1891 were 12,775, an increase of 7.52 per cent. over 1890; the number granted, 5,550, or 43.5 per cent., against 39.5 per cent. granted in 1890. Since 1887 there has been, in fact, not only a yearly increase in patents applied for but in patents granted; while from 1883 to 1887 the number granted decreased yearly. The number of those applied for in chemical and related industries, were 5,554; the number granted, 2,506, or 43.5 and 45.2 per cent. of the whole number applied for and granted. The United States led among the

Fig. 2.—McCreary Three-Light Reflector Fixture.

foreign states in number of patents granted (509); Great Britain came next with 497; Austria, 313; France, 237; Switzerland, 93; Belgium, 56; Russia, 53; and Sweden and Norway, 47. The greatest number applied for and granted under one class was for electrical invention, not including lighting.

Magnetic Iron Rust.

At a recent meeting at Hobart, Tasmania, of the Australasian Association for the Advancement of Science, Professor Liversidge, F. R. S., of the University of Sydney, read a suggestive paper on the rusting of iron. The author remarked that in books upon chemistry it is usually stated that iron rust is composed of the hydrated sesquioxide of iron; but on examining a very large number of specimens of rust from many different places, and from iron articles of various kinds, and formed under very varied conditions, Prof. Liversidge has found that in almost every instance the rust contained more or less magnetic oxide. Indeed, in some cases, the rust, although presenting the usual rust-brown color and appearance, was, when powdered, practically altogether attracted by the magnet. The specimens of rust which first drew the author's attention to this subject were large rust scales obtained from some old tramway metals, which he was led to collect and examine on account of their resemblance to the crust so often present upon metallic meteorites. On crushing these scales in a porcelain mortar, and testing the dust with a magnet, it was found to be wholly susceptible to magnetism, owing to the small quantity of magnetic oxide present being mechanically inclosed in the rust particles. The production of this magnetic oxide does not seem to have been due to the presence of mill scale, because, when bright iron wire, plates, rods, nails, etc., were artificially rusted in many ways with free access to oxygen, in almost every instance a large amount of oxide was formed. These observations have some practical bearing upon the problem of the preservation of wrought iron structures from rust.



Cutter's Conduit Connector.

Detroit Electrical Works.

The Citizens' Street Railway Company, of Detroit, has awarded the entire contract for the equipping of their Jefferson avenue line with electricity to the Detroit Electrical Works. The contract includes the entire power plant station, overhead lines and motor equipments, as follows:

Power station steam plant to consist of three horizontal return tubular boilers, 66 inches in diameter, 16 feet long, each to have 60 four inch flues. Three 14x24x14 Westinghouse automatic compound engines, with all necessary apparatus, such as feed water heater, pump, injectors, piping, smokestack, etc.

Power station electric plant to consist of three 100 kilowatts multipolar railway generators of the Detroit Electrical Works' latest type, and slate switchboard of the latest and most improved design, with all instruments and attachments necessary to make a complete electric plant.

The overhead construction will consist of two No. 0 B. and S. gauge hard drawn copper trolley wires, with necessary feeders and guard wires, supported on Milliken iron poles, the standard to be used for that portion of the avenue which is 70 feet from curb to curb, and their extra heavy type for that portion which is 80 feet from curb to curb.

The motor equipment will be twelve 40 horse power motor equipments of the Detroit Electrical Works' standard type. If the work is not delayed by injunctions or measures of that character, it is expected that the plant will be in operation in about 75 days. As this will be the first line running through the center of the city of Detroit to be equipped with electricity, the plant is to be made a model one in every respect, to which end the Detroit Electrical Works are making provision for building same on the most approved lines, and include all of the latest appliances.

As this contract is only one of a number that have lately been awarded the Detroit Electrical Works in face of sharp competition, it shows that this company is fully substantiating their claims that their equipments, using one motor geared to both axles, have great advantages.

The extensions to the factory of the Detroit Works are now nearing completion, and they expect soon to have the same equipped and in operation, when they will undoubtedly be in better position to push the business as competition requires.

ELECTRIC LIGHT NEWS

—— J. T. Barber and others will construct a new electric light plant at Eau Claire, Wis.

—— The electric light plant at Goshen, Ind., was inundated by the recent rise of the Elkhart river.

—— The electric light plant at Van Wert, Ohio, has been sold to Gen. S. V. Rice, of Ottawa, O., for $19,500.

—— The smallest place in the country lighted by electricity is said to be Springport, Jackson County, Mich.

—— The Rahway, N. J., Electric Illuminating Company has purchased ground on which to build a new station.

—— The Morrison, Ill., Electric Light & Power Company has decreased its capital stock from $25,000 to $20,000.

—— The Haywards electric light plant at Haywards, Cal., was burned last week, causing a loss of $100,000; uninsured.

—— The Western Electric Light and Power Company, of Toledo, O., has increased its capital stock from $20,000 to $200,000.

—— The Charlotte Electric Company has sold its entire plant and franchise in Detroit to W. P. Engel, of Chicago, who will probably be its future manager.

—— Street railways are to be built at Colombo, Ceylon, and proposals for their construction will be received until September 30 by the Mayor, Mr. H. Hay Cameron.

—— Governor Flower has signed a bill authorizing the Mayor of Brooklyn to appoint a commission on electrical subways in Brooklyn, to consist of two members, each to receive a salary of $3,000.

—— Sealed bids for the construction of an electric light plant for the town of New Llano will be received up to noon, Monday, May 23, 1892, by the Llano Improvement and Furnace Company, Llano, Texas.

—— The Commercial Club, composed of the merchants of Columbus, Ind., has organized a company with a capital of $20,000, and has been granted a franchise to erect and maintain an incandescent light plant in that city. Work will be begun at once.

—— The directors of the Fort Wayne Electric Company have declared a semi-annual dividend of 50 cents per share, payable May 16 to stockholders of record at the close of business May 13. Books to be closed from May 14 to 16, both days inclusive.

—— Judge Shiras has denied the Thomson-Houston and St. Louis Companies' application for a receiver for the Allen & Swiney electric light plant at Dubuque, Ia. At the instance of the judgment of creditors, the United States marshal, on May 5, levied upon the Allen & Swiney electric plant, another application for a receiver having been made.

—— Objection has been raised to the use of the electric arc in electric welding because of its effect upon the eyesight. A large foundry firm has written to the papers to state that they have for two years used the Bernardos process of welding on an extensive scale in the manufacture of tubes and fittings, elbows, bends, etc., for marine engineering and other purposes, and they have not during the whole of that period had a single case in which the eyesight of the operator suffered permanently from the light emitted by the electric arc. For the purpose of protection they have uniformly used a specially prepared, extremely dark, non-actinic ruby glass, and they condemn the ordinary blue glass or non-actinic photographer's glass as entirely useless for the purpose.

KINDRED INTERESTS

The Kerite Company has removed its New York office from 16 Dey street to the elegant new *Mail and Express* building, 166 Fulton street. Office No. 310 will be occupied by the Kerite works, overlooked by General Manager W. R. Brixey.

The Short Electric Railway Company, of Cleveland, through its New York office, has recently sold 53 electric railway equipments in New England. All the roads which purchased this apparatus are expected to be in operation early in June.

The Extensive Facilities of the Billings and Spencer Company, of Hartford, Conn., are at present taxed to their utmost capacity, and among their large orders in the electrical field is one from the Edison General Electric Company for 40 tons of drop forged copper commutator bars.

The West Shore Railroad will run an excursion to Niagara Falls on Saturday, May 28, 1892. The tickets are good for return on any regular train on or before May 31. Any ticket agent of the West Shore Railroad can give full particulars of this excursion, which promises to be a very interesting trip.

The New England Engineering Company, of Waterbury, Conn., report having just closed a contract for the extension of the Johnson City and Carnegie Railway Company, at Johnson City, Tenn., and for the furnishing of additional rolling stock. The New England Engineering Company constructed and equipped this road in the Summer of '91.

The McGuire Manufacturing Company, Chicago, makers of the well known McGuire trucks for street cars, are building a 60x80 extension to their North Sangamon street factory. This company is now operating its three factories on full time, and in some cases working over time, the demand for their goods being such as to make this absolutely necessary.

The Sedalia Daily and Weekly Democrat, of Sedalia, Mo., will henceforth run its printing press by electricity. The Edison Company have installed a three horse-power standard Edison motor in the Equitable Building, Sedalia, Mo., for this purpose. Current will be taken from the mains of the Electric Railway, Light and Power Company, of that town.

The Standard Electric Time Company, of New Haven, Conn., have just completed the fitting up of the Drexel Institute, of Philadelphia, with their system of electric clocks. The outfit includes a large tower clock and 27 others in prominent class rooms, regulated from it. They have also put in a tower clock and dials in the waiting rooms of the new Chesapeake and Ohio Railroad depot at Newport News.

The Berlin Iron Bridge Company, East Berlin, Conn., have received the contract for the new rolling mill which the Waterbury Brass Company, of Waterbury, Conn., will build to replace the one lately destroyed by fire. It is said that this will be the finest rolling mill in the Naugatuck Valley, being 150 feet in width by 350 feet in length, with brick side walls and iron roof trusses covered with the Berlin Bridge Company's patent anti-condensation corrugated iron roof covering. The building will be absolutely fire-proof.

At a Meeting of the directors of the Elektron Manufacturing Company, held recently in New York, it was decided to increase the facilities of their plant 50 per cent. This action was taken in view of the greatly increased demand for their goods and the excellent showing already made since the establishment of their plant in Springfield, Mass. Mr. E. H. Cutler, the general manager of the company, states that previous to the last increase the plant has been turning out double the amount of work possible in their old works in Brooklyn.

One of the neatest business envelopes that comes in the REVIEW's mail is that used by The E. P. Allis Company, the prominent engine manufacturers of Milwaukee, Wis. The envelope is white, 6⅛x3⅛ inches in size. In the upper left hand corner is a red square, each side being ⅞ of an inch long, on which is represented a white seal with these words in red: "The E. P. Allis Co. Reliance Works, Milwaukee, Wis." When a red two cent stamp is placed on the opposite end of the envelope the effect is at once prominent and striking. Like the Allis engines, this envelope is well designed, it "goes" and accomplishes its object.

The Elektron Manufacturing Company, Springfield, Mass., has received the following letter:

BOSTON, MASS., April 26, 1892.

E. H. CUTLER, Esq., Manager The Elektron Manufacturing Company, Springfield, Mass.

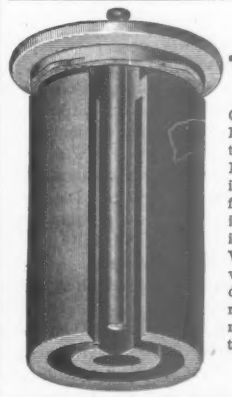
DEAR SIR: You wanted me to inform you when we arrived from our southern cruise how the dynamo you furnished us worked. It is all summed up in the one word, *perfect*. It is very easy to take care of and has given perfect satisfaction in every sense of the word, and is just the kind needed for steamboat work.

Hoping that all the dynamos you may furnish will give as good satisfaction as this one, I remain,

Yours most respectfully,
JOHN A. CURRIER, Chief Engineer,
Yacht "Wild Duck," East Boston.

Electric Launch at the Crystal Palace Exhibition.—Messrs. Woodhouse & Rawson have lately added to their stand at the Crystal Palace an electric launch. The "Lily," as she is named, is 28 feet long, and has a beam of 5 feet 6 inches, a depth of 2 feet 10 inches, and a draft of 2 feet. The sides of the boat are carved, built of mahogany, with American elm keel and timbers, and she has an oak stem, stern post and dead-wood. The electrical equipment consists of a two horse-power "W. & R." motor, supplied with current from 30 "Epstein" cells. Her weight complete is 25 cwt. She will hold from 12 to 15 passengers, and with one charging, which occupies about four hours, will run at full speed (seven miles an hour) for five hours.

A Fine Vessel.—The new Sound steamer "Maine," which was recently put in commission between New York and Stonington, Conn., by the Providence and Stonington Steamship Company, is the finest passenger craft now in service on Long Island Sound. The "Maine" will soon have to divide honors with her sister ship the "New Hampshire," which will presently be making regular trips. The "Maine" is a steel hull propeller embodying many novel features in naval construction. She is equipped with an electric search-light and the economical distribution of the interior lighting arrangements is very beautiful and effective. One of the pleasantest features of the "Maine" is that the dining-room is situated on the upper deck, where the traveler can eat in cool and quiet, and at the same time enjoy the beautiful scenery along the picturesque Sound. A voyage on the "Maine" is a real pleasure.



THIS is a cut of the Law Battery Double Cylinder Carbon Element attached to cover with zinc. It has 147 square inch carbon surface. The element is everlasting and is so guaranteed. Why use a battery with a chemical depolarizer that needs frequent renewal of the negative element?

LAW BATTERY COMPANY,
85 JOHN STREET, N. Y.

FOR SALE.

One 10 H. P. Baxter Motor.
One 5 " " "
One 3 Arc Light Dynamo.
One 25 Incandescent Light Dynamo, 220 volts.
One 15 " " " 110 "
One 2 H. P. Motor, 500 volts.
One 1 " " 500 "

All in good condition.

A. H. ARP,
511 FIFTEENTH STREET,
MOLINE, ILL.

MACHINERY IN STOCK.

Engine Lathes, 10 in. x 4 ft.; 11 in. x 5 ft.; 12 in. x 6 ft.; 14 in. x 6 ft.; 16 in. x 6 ft.; 18 in. x 8 ft.; 20 in. x 8 ft., with tapes attachment; 22 in. x 12 ft. and 14 ft.; 24 in. and 26 in. x 16 ft.; 30 in. x 10 ft. and 18 ft.; 36 in. and 38 in. x 20 ft.; 42 in. x 12 ft.; 27 in. x 32 ft.; 66 in. x 31 ft.; 96 in. x 20 ft. Fox Lathes, 13 in. x 5 ft.; 14 in. x 5 ft.; 15 in. x 6 ft.; 18 in. x 6 ft. Turret Lathes, 13 in. x 5 ft.; 14 in. x 5 ft.; 15 in. and 16 in. x 6 ft.; 18 in. x 6 ft.; 36 in. x 8 ft.

Planers, 16 in. x 16 in. x 3 ft.; 20 in. x 20 in. x 4 ft.; 24 in. x 24 in. x 6 ft.; 30 in. x 30 in. x 6 ft.; 36 in. x 36 in. x 10 ft.; 42 in. x 42 in. x 12 ft.; 44 in. x 48 in. x 22 ft.; 60 in. x 49 in. x 24 ft.

Friction Shapers, 15 in., 16 in., 20 in., 22 in., 32 in.

Crank Shapers, 6 in., 8 in., 10 in., 12 in., 13 in., 16 in., 17 in., 20 in., 24 in., 28 in.

Screw Machines, Nos. 1, 2, 3, 4, with or without Wire Feed.

Screw Machines, Nos. 5, 6, 7, 8, Power Feed.

Presses, Nos. 51, 52, 53, Ferracute; Nos. 1, 2, 3, Stiles & Parker.

5 Lincoln Pattern Millers, No. 2.

Hand Millers, Nos. 1 and 2. 3 Cam Cutters.

Bolt Cutters, ¼ in. to 1 in., ½ in to 2 in.

2 Profiling Machines. 1 36 in. and 48 in. Gear Cutter.

C. D. and E. Horizontal Boring Machine. Newark Machine Tool Co.

Send for List of New and Second-Hand Machinery in Stock.

PRENTISS TOOL & SUPPLY CO., P. O. Box 3362,
115 Liberty Street, New York.
59 South Canal St., Chicago, Ill.

THE LEHIGH VALLEY
CREOSOTING CO.
WORKS, PERTH AMBOY, N. J.
Office, Foot of Washington Street, JERSEY CITY, N. J.
Creosoted Lumber, Underground Conduits. Telegraph Poles, Piling and Ties Furnished.

Robb MacKie,
CONSULTING ELECTRICAL ENGINEER,
Neave Building,
CINCINNATI, O.

Judicial Sale of Electric Street Railway.

BARROW vs. ST. CATHARINES, MERRITTON AND THOROLD STREET RAILWAY COMPANY,

By virtue of the judgment herein and the order for immediate sale, there will be sold, with the approbation of J. E. O'Reilly, Esquire, Local Master at Hamilton, at the Grand Central Hotel, St. Catharines, on Saturday, the 28th day of May, A.D. 1892, at noon, by S. Robinson & Son, Auctioneers, the undertaking known as "The St. Catharines, Merritton and Thorold Street Railway," including the rolling stock and equipments thereof, full details and particulars of which can be obtained on application to the Vendor's Solicitors.

The undertaking consists of a valuable water-power, with the necessary machinery for generating electricity, at Merritton, over six miles of track and wires, cars, motors, office, sheds, etc. There is estimated to be a surplus of 200 horse-power over the requirements of the railway, which can be utilized for supplying power and light to manufactories, residences, etc.

TERMS: 10 per cent. on the day of sale, and the balance without interest 30 days thereafter. The property will be sold subject to a reserved bidding fixed by the Master.

Further particulars and conditions of sale may be obtained on application to T. E. Nihan, Receiver and Manager, St. Catharines, or to Bruce, Burton & Bruce, Canada Life Chambers, Hamilton, Ontario, Canada, or to

NESBITT, BICKNELL & GAULD,
VENDOR'S SOLICITORS,
Canada Life Chambers,
Hamilton,
Ontario, Canada.

J. E. O'REILLY,
LOCAL MASTER AT HAMILTON.

ELECTRICIAN WANTED.

Practical young man to take charge of complete small plant, ready for business, in connection with long established machine concern. Repair work and new work—good field—**CHANCE TO GROW.**

Address, Connecticut,
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AN ELECTRICAL LIBRARY.

OPPORTUNITY FOR BEGINNERS.

A Comprehensive, Carefully Selected, yet Inexpensive, List of Instructive Electrical Books.

In response to the many inquiries from all parts of the country as to the best books for those who are desirous of becoming posted in the rudiments of Electricity in its various branches, and in an endeavor to afford beginners as wide a range of reading as possible for a comparatively small outlay, the Book Department of the **ELECTRICAL REVIEW PUBLISHING COMPANY** makes the following offer:

We will send by *express, prepaid,* on receipt of **$15.00,** fourteen books by the most popular authors, especially adapted for a course of elementary reading, including the **ELECTRICAL REVIEW** for one year, as follows:

PRACTICAL ELECTRICITY, - By *Ayrton*
ELEMENTS OF ELECTRIC LIGHTING, - - - - By *Atkinson*
DYNAMO TENDER'S HAND-BOOK, By *Badt*
INCANDESCENT WIRING HAND-BOOK, - - - - By *Badt*
THE DYNAMO, - - - By *Bottone*
ELECTRIC BELLS AND ALL ABOUT THEM, - - By *Bottone*
ELECTRICITY FOR ENGINEERS, By *Desmond*
THE TELEPHONE, - - By *Dolbear*
ALTERNATE CURRENT MACHINERY, - - - - - By *Kapp*
INCANDESCENT ELECTRIC LIGHTING, - - - - - By *Latimer*
A, B, C, OF ELECTRICITY, By *Meadowcroft*
ELECTRICITY SIMPLIFIED, - By *Sloane*
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REMEMBER: $15.00 buys all of the above, delivered to your office or residence.